COMMONWEALTH BUREAU OF HELMINTHOLOGY,
THE WHITE HOUSE,
103, ST. PETER'S STREET,
ST. ALBANS, HERTS.
22.10.58

Vol. 41, No. 2, 1958

THE MALAYAN AGRICULTURAL JOURNAL

PRINCIPAL CONTENTS

THE VEGETATIVE PROPAGATION OF TEA ON THE LOWLANDS OF MALAYA *By C. Whitehead.*

COCOA DRYING. *By D. W. M. Haynes.*

THE CULTIVATION OF TOMATO AS AN OFF-SEASON CROP ON PADI LAND *By J. S. Ure and Lim Eow Hwa.*

NOTES ON THE CULTIVATION OF RAUWOLFIA IN MALAYA. *By E. F. Allen.*

MASTER FARMERS OF MALAYA, VII. TUAN SEMBOK. *By Mohamad bin Jamil.*

NOTES ON CURRENT INVESTIGATIONS AND EXTENSION WORK, JANUARY TO MARCH, 1958.

MINISTRY OF AGRICULTURE, FEDERATION OF MALAYA,
Kuala Lumpur.

PRICE $2

DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA

ORGANIZATION (as on 30th June, 1958)

Director of Agriculture:—P. G. Coleman, M.A., A.I.C.T.A. (*Acting*).
Deputy Director of Agriculture:—A. L. Barcroft, B.Sc. (Agric.) (*Acting*).
Administrative Officer:—H. F. Logan
Executive Officer:—Yap Sin Hee.
Financial Assistant:—V. Sundram.

RESEARCH BRANCH

Assistant Director (Research):—
A. Johnston, B.Sc. (Hons.), A.I.C.T.A. (*Acting*).

(II) BOTANY

Senior Botanist:—
F. B. Brown, B.Sc. (Hons.), Dip. Agr. Sci. (Cantab.).
Plant Breeders:—
A. V. Haddon, B.Sc. (Hons.), Dip. Agr. Sci. (Cantab.).
Van Thean Kee, B.Sc. (Hons.).
A. Santiago, B.Sc. (Malaya), M.Sc. (Alta.).
One vacancy.
Plant Physiologists:—
J. Dore, B.Sc. (Hons.), Ph.D., A.R.C.S.
*R. G. Lockard, B.S.A., M.Sc. (Agric.), Ph.D.
Asst. Research Officer:—
Tak bin Haji Daud, M.B.E.

(III) CHEMISTRY

Senior Chemist:—
F. N. G. Conaty, B.Sc. (Hons.), A.R.I.C.
Canning Officer:—
One vacancy.
Chemists:—
Miss M. Smith, B.Sc. (*Temporary*).
One vacancy.
Assistant Chemist:—
Kao Wei Tsan, B.Sc. (Lingnan).

(IV) SOIL SCIENCE

Senior Chemist (Soils):—
A. R. McWalter, B.Sc. (Hons.) (*Acting*).
Chemist (Soils):—
G. W. Arnott, B.Sc. (Hons.), D.T.A.
K. Kanapathy, B.Sc. (Hons.) (Annamali), M.Sc., A.R.I.C.
Geologist (Soil Survey):—
W. P. Panton, B.Sc. (Hons.), D.T.A.
Asst. Research Officer:—
S. Thamboo.

FIELD BRANCH

Assistant Director (Field):—
H. D. Matheson, B.Sc., D.T.A. (*Acting*).
Agricultural Officer, Headquarters:—
Mohamad bin Jamil, B.Sc., D.T.A.
Agricultural Economist:—
T. B. Wilson, M.A. (Hons.), (Oxon.), Dip. Agric. Econ., D.T.A.
S. Selvadurai, B.A. (Hons.)
Personal Assistant to Asst. Director (Field):—
Yoon Weng Kong.
KEDAH: *State Agricultural Officer*:-
J. S. Ure, B.Sc., D.T.A. (*Acting*).
Agricultural Officer:—
Vacant.
Asst. Agricultural Officers:—
Othman bin Mohd. Lela.
Haji Mohd. Salleh bin Musa, I.S.M., P.K.K., L.S.M.
PERLIS: *State Agricultural Officer*:—
Mohd. Noor bin Wahab, B.Sc. (Agric.) (Dunelm.).
KELANTAN: *State Agricultural Officer*:—
J. L. B. Hitchcock, B.Sc. (Dunelm.).
Agricultural Officer (Vacant).
Asst. Agricultural Officer:—
Hj. Mahmood bin Haji Yaacob, S.M.K.
TRENGGANU: *State Agricultural Officer*:—
Basir bin Ismail, B.Sc., (Agric.), (Dunelm.).
Asst. Agricultural Officer:—
Mohd. Noor bin Haji Abdul Hamid.
PENANG & PROVINCE WELLESLEY:
State Agricultural Officer:—
Ahmad bin Mohd. Amin, B.Sc. (Agric.).
Asst. Agricultural Officer:—
Mohd. Noordin bin Mohd. Kassim.
PERAK: *State Agricultural Officer*:—
T. R. Dickinson, B.Sc. (Agric.), Dip. Agr. (Cantab.) D.T.A. (*Acting*).
Agricultural Officer:—
Perak North—Vacant.
Tak bin Hj. Daud, (A.R.O.)
Perak Central—Vacant.
Perak South—
R. J. R. Barrett, B.A. (Hons.) (Cantab.), Dip. Agric. (Cantab.).
Asst. Agricultural Officer:—
Mohd. Ibrahim bin Mohd. Ali.
Shahidin bin Mohd. Hassan

* Supernumerary appointment under the Colombo Plan.

(Continued)

RESEARCH BRANCH (contd.)

(V) ENTOMOLOGY

Senior Entomologist:—(*Vacant*).
A. Johnston (In charge).

Entomologists:—
One vacancy.

Asst. Research Officer:—
Kamardin bin Bahar.

(VI) PLANT PATHOLOGY

Senior Plant Pathologist:—
A. Johnston, B.Sc. (Hons.), A.I.C.T.A.

Plant Pathologist:—
S. J. Navaratnam, B.Sc. (Hons.). (*On study leave*).

AGRONOMY BRANCH

Senior Agronomist:—
C. Whitehead, B.Sc. (Hort.) D.T.A., (*Acting*).

Agronomists:—
G. I. M. Martin, B.Sc. (Agric.), Dip. Agric. (Cantab.), D.T.A., S.D.D.H. (*Kedah*).
D. F. Darnell, B.Sc. (Agric.), Dip. Agric. (Cantab.), D.T.A.
Lee Sin Fook, B.Sc. (Agric.).
Six vacancies.

Agricultural Engineers:—
Wan Don Mohamad, B.Agr.
One vacancy.

Livestock Officer:—*Vacant.*

Statistician:—(*Vacant*).
I. Watson, B.Sc., (Hons.). (*Temporary*).

Asst. Statistician:—Lee Yoke Heng.

Agricultural Development Officers:—
J. A. Cox, A.M.I.B.A.E.
A. I. Cumming, Ass. Mem. A.S.A.E., A.M.I.B.A.E.
Ahmad bin Jamal.
N. Kanagaratnam.
One vacancy.

PUBLICATIONS BRANCH

Publications Officer:—(*Vacant*).
Mrs. J. Wilson, B.A. (Hons.), (Oxon) (*Temporary*).

Librarian:—
P. J. Verghese.

FIELD BRANCH (contd.)

SELANGOR: *State Agricultural Officer*:—
H. D. Matheson, B.Sc., D.T.A.
Agricultural Officer, Coast (North):—
Vacant.
Asst. Agricultural Officer:—
Zakaria bin Abdul Rauf, P.J.K.

PAHANG: *State Agricultural Officer*:—
Omar bin Buyong, B. Agric. (*Acting*).
Agricultural Officer:—*Vacant.*
Asst. Agricultural Officers:—
Pahang North—
Ng Ngok Wah.
Pahang East—
Mohd. Muda bin Mahmood.
Pahang South—
Wan Abdul Aziz bin Ungku Hj. Abdullah, (*Orang Kaya Indera Pahlawan*).
Agricultural Asst. i/c F.E.S. Cameron Highlands—
T. Sockalingam.

NEGRI SEMBILAN:
State Agricultural Officer:—
L. A. Vivian, B.Sc., Dip. Agr. (Cantab.), D.T.A.
Asst. Agricultural Officer:—
Saidin bin Dain, P.J.K.

MALACCA: *State Agricultural Officer*:—
L. A. Vivian
Asst. Agricultural Officer:—
Ali bin Mohd. Salleh.

JOHORE: *State Agricultural Officer*:—
Mohd. Tamin bin Yeop, B.Sc. (Agric.). (*Acting*).
Agricultural Officers:—
Johore Central—Vacant.
Johore West—Vacant.
Asst. Agricultural Officer, Johore South:—
Tan Guan Chye.

AGRICULTURAL EDUCATION BRANCH

Principal, College of Agriculture, Malaya:—
Chew Hong Jung, B.Sc. (Hons.), B. Agric. (*Acting*).

Senior Lecturer:—
Khalid bin Abdul Rahman, B.Sc. (Agric.).

Registrar and Bursar:—
Yap Chin Hee.

Assistant Lecturers:—
G. R. Kurup, B.A.
Abdul Hamid bin Haji Hussein.
Mrs. V. Thomas, B.Sc., M.Sc. (Madras), (*Temporary*).
Mrs. M. Joseph, B.A. (Madras), (*Temporary*).

GOOD OPPORTUNITY FOR ESTATES WITH DRAINAGE PROBLEM

Self Propelled Drain Digging Machine available for immediate delivery comprising almost new Tractor Mounted Model 80 RTM Hopto Digger complete with Fordson Major Diesel Tractor as power and traction unit.

Hopto Diggers are being used chiefly for digging Scupper Drains in low lying coastal clay districts such as Bagan Datoh, Perak, with great success and economy.

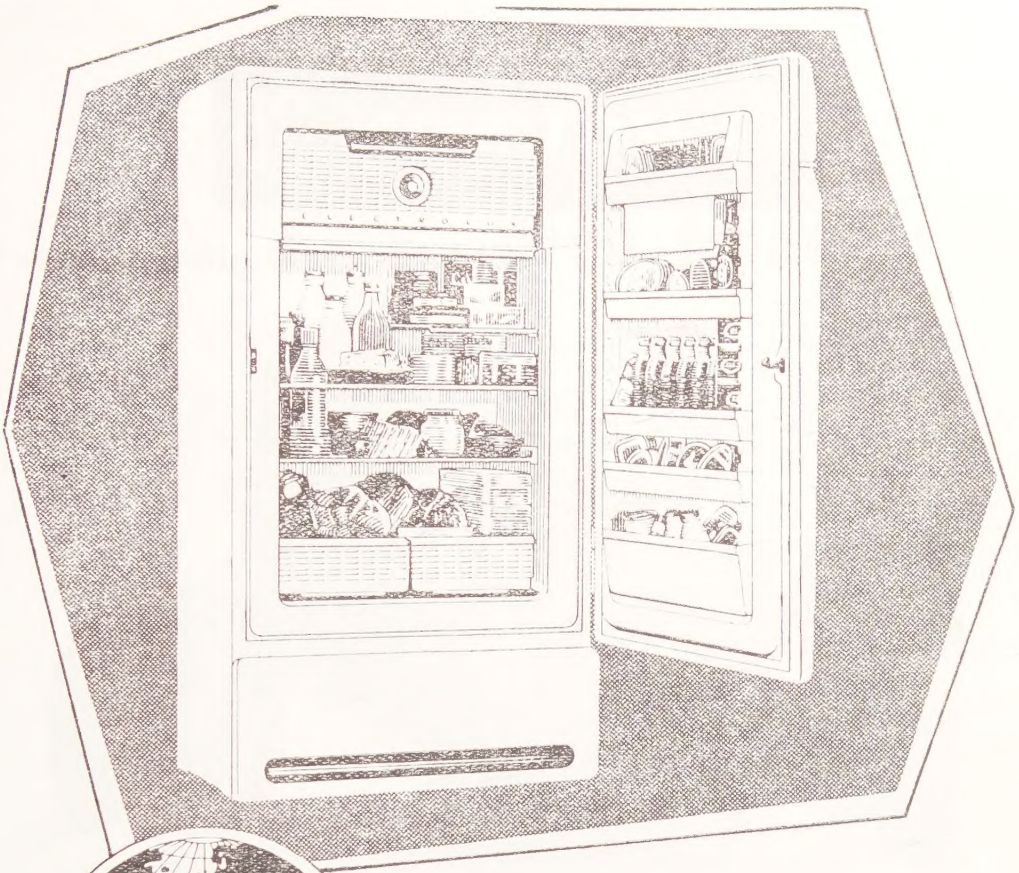
The Tractor can be disconnected from the Digger on completion of a drainage programme and used for other purposes.

For particulars please write to:—

THE MANAGER,

KUALA PERAK ESTATE,

TELUK ANSON, PERAK.



Electro-lux

the world mark

More than 20 million products make Electrolux a household name the world over.
Electrolux refrigerators are on active service in 100 countries on 5 continents.
There is an Electrolux refrigerator for every need; for operation by kerosene, gas or electricity. Every Electrolux refrigerator carries a 5 year guarantee.
For quality and service — Electrolux.

KEROSENE OPERATION

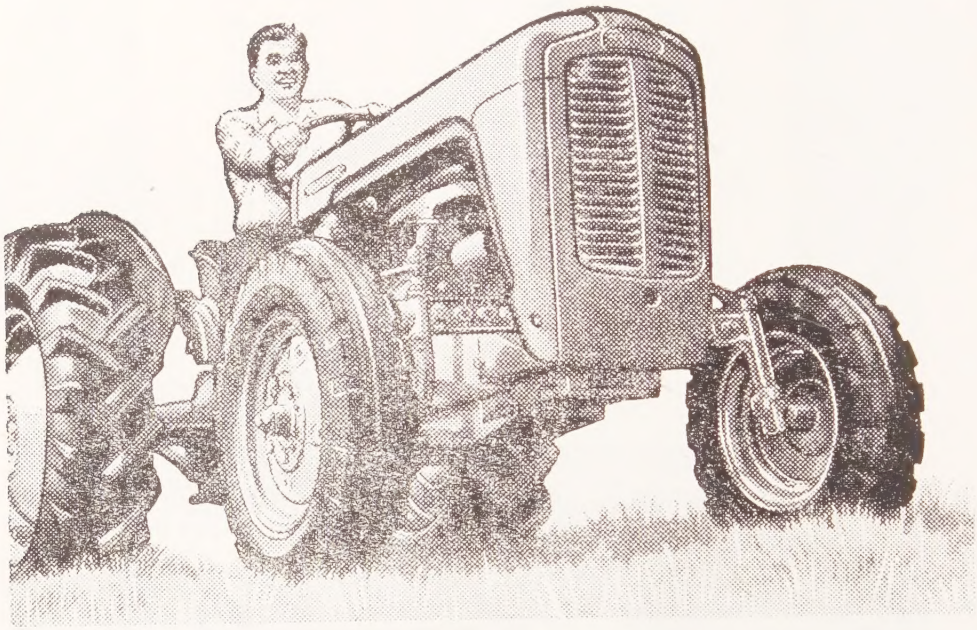
ELECTROLUX

Sime Darby 美那森

ADVERTISEMENT

FERGUSON 35

outdates every other tractor!



Never before a tractor with all the features you need!

Look carefully at the new Ferguson features below. Compare the Ferguson 35 with other new tractors. You'll see how it outdates them—makes them old-fashioned already. And remember—the Ferguson 35 has what no other tractor has . . . the all-important basic benefits of the Ferguson System . . . tried, tested and now *improved!*

NEW *NEW Hydraulic control!*

NEW *NEW Two power-take-offs in one!*

NEW *NEW "Two-way" depth control!*

NEW *NEW Gear box!*

NEW *NEW Constant overload release!*

NEW *NEW Independent brake pedals!*

NEW *NEW Great diesel engine—37 brake horsepower!*

NEW *NEW Safety, comfort and convenience features!*

With all these vital advantages, the Ferguson 35 gives you what you need from a tractor; greater output—in less man-hours. It raises your margin of PROFIT. *See us about a free demonstration today!*

BORNEO MOTORS LIMITED

SINGAPORE — K. LUMPUR — MALACCA — SEREMBAN — IPOH
PENANG — BUTTERWORTH — JESSELTON — K. BELAIT — KUCHING

Free from lallang

When replanting, clear your estate of lallang with Shell Lallang Oils. They cannot harm trees under normal conditions of use, and can be used with complete safety anywhere. Shell Lallang Oils will eradicate lallang completely, but will not prevent a light cover of vegetation from arising. Safe and simple to use, they have exceptional staying power in the face of heavy rainfall.

The cost of treating an estate can vary greatly from place to place, but an average cost of eradicating lallang with Shell Lallang Oil is $150 an acre including labour, transport and depreciation of spraying equipment. This is the modern way, the safest way and in the long run the cheapest way of performing this essential task.

For further information, consult your nearest Shell branch.

SHELL

SHELL LALLANG OILS

Pest control — suddenly

To obtain immediate control of insect vectors of disease, a fine fog of insecticide dispersed over a wide area is the only answer. A fog is also effective in clearing a building of insects quickly.
The effective insecticide is *Dieldrex 15*, already proven in the Malay Peninsula.
The machine to provide the fog is . . .

swingfog

the versatile pulse-jet fogging machine. Portable, simple to use, thoroughly effective; hundreds are in use in Malaya. For details of independent trials conducted by public health authorities, write to Malayan Fertilisers Limited, P.O. Box 157 Kuala Lumpur; Sole Agents for Swingfog in this area.

SHELL

DIELDREX 15 *the public health insecticide*

for your information

The supply of ESTATE CHEMICALS is a service which we have performed for many years for the planter.

Our wide range covers Alum Crystals, supplied in paper-lined Hessian Bags of 112 lbs.; Barium Carbonate Precipitated in one cwt. bags.; DDT Powder, Sodium Sulphite for factory and field uses; Ammonia Solution; Granular Sodium Arsenite for the eradication of Lallang; Paranitrophenol, etc.

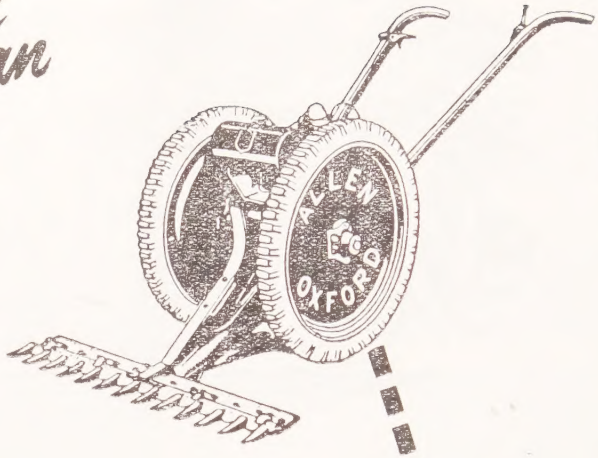
These are but few of the lines we stock. Forward us your order or call and discuss your problem with our technical experts.

ESTATE CHEMICALS? SEE JAMES WARREN!

JAMES WARREN

SINGAPORE · KUALA LUMPUR · IPOH · PENANG

Wherever a man can follow— the ALLEN Scythe will cut



Sime Darby 美那士

THE ALLEN SELF-PROPELLED MOTOR SCYTHE embodies the great experience gained during the twenty three years of manufacturing this machine, and is the result of continuous, careful study of the differing requirements of users throughout the world.

The 3 h.p. engine drives both the cutting mechanism and road wheels. There is ample power to drive the scythe even through dense lallang and high blukar and it will climb steep hillsides up to 1 in 1 quite easily. The scythe is simple to operate, and has proved its worth to estates, municipalities, and P.W.D. in all parts of Malaya and Singapore.

The Model "TS" is now available and incorporates several improvements, the chief of which is a mechanical Servo clutch withdrawal mechanism. It is also fitted with a longer axle for greater stability on slopes, Forestry Guards to allow a better flow of the cut material, and Allen patent adjustable pads, which ensure correct adjustment of the cutting assembly.

There's always a job for the ALLEN

ATTACHMENTS

- SPRAY PUMP
- CENTRIFUGAL PUMPS
- HOES AND CULTIVATORS
- HORTICULTURAL PLOUGH
- CIRCULAR SAW
- MOWER ROLLER
- TRAILER SEAT
- CARRIER
- TRAILER
- KNIFE SHARPENER
- VACUUM PUMP

However Large...

. . . however small

YOUR PROBLEM MAY BE

our **AGRICULTURAL** and

TECHNICAL ADVISORY

SERVICES

are at your disposal

ICI FOR AGRICULTURE

Insect Pests of Economic Importance

Caterpillar of *Attacus atlas* L. (The Atlas Moth)

The giant-size caterpillar of the Atlas Moth, illustrated above, which develops to 4½ inches in length is more of a source of wonder to the visitor and delight to the zoological student than a serious pest in Malaya. Caterpillars in general, however, can do an enormous amount of damage in a very short period of time and, due to their frequent moultings may be unaffected by some of the newer types of insecticides. Control, to the best advantage, lies frequently in the knowledge of the adult concerned and the crop affected since certain insecticides must not be applied to edible crops for some days previous to consumption. Where such information is lacking a suitable, non-hazardous insecticide of easy application is **D D T 25% Miscible Liquid, 'Cock's Head' Brand,**

ICI

FOR AGRICULTURE

THE

Malayan Agricultural Journal

Edited by the Publications Officer with the Assistance of the Publications Committee.

Vol. 41, No. 2. **1958.**

Page

Editorial 77

ORIGINAL ARTICLES

The Vegetative Propagation of Tea on the Lowlands of Malaya. *By C. Whitehead, B.Sc. (Hort.), D.T.A.* 79

Cocoa Drying. *By D. W. M. Haynes, B.Sc.* 88

The Cultivation of Tomato as an Off-Season Crop on Padi Land. *By J. S. Ure, B.Sc., D.T.A. and Lim Eow Hua* .. 94

Notes on the Cultivation of Rauwolfia in Malaya. *By E. F. Allen, M.A., Dip. Agr. Sci. (Cantab.) A.I.C.T.A.* 100

Master Farmers of Malaya, VII. Tuan Sembok. *By Mohamad bin Jamil, B.Sc., D.T.A.* 106

Notes on Current Investigations and Extension Work. January to March, 1958 110

Review 120

STAFF NOTES

Promotions, Retirements, etc 123

STATISTICS

Market Prices, Production and Export Data for Selected Agricultural Products 123

Meteorological Summaries 128

THE MALAYAN AGRICULTURAL JOURNAL

The Journal which is published quarterly, is designed to present — as far as possible in non-technical terms — the results of the agricultural research, investigation and extension work performed by the Department of Agriculture and it draws attention to the results of work of a similar nature in other countries.

The price of the Journal is $2/- per copy or $8/- per annum, post free, in Malaya; it is $8.50 or £1 sterling, post free, outside Malaya.

The Journal and other publications may be obtained from the Department of Agriculture, Kuala Lumpur, Federation of Malaya, or from the office of the Commissioner for Malaya in the United Kingdom, 57, Trafalgar Square, London, W.C.2.

COMMITTEES OF THE DEPARTMENT

The Standing Committee on Investigations :

The Deputy Director of Agriculture. **(Chairman).**
The Assistant Director of Agriculture. (Research)
The Assistant Director of Agriculture. (Field).
The Senior Agronomist.
The Agricultural Officer, Headquarters. (Secretary).

The Publications Committee :

The Director of Agriculture, Federation of Malaya. **(Chairman).**
The Deputy Director of Agriculture.
The Assistant Director of Agriculture. (Research).
The Assistant Director of Agriculture. (Field).
The Senior Agronomist.
The Publications Officer. **(Secretary).**

The Examinations Board :

The Deputy Director of Agriculture. **(Chairman).**
The Assistant Director of Agriculture. (Research).
The Assistant Director of Agriculture. (Field).
The Senior Agronomist.
The Principal, College of Agriculture, Malaya.
The Administrative Officer. **(Secretary).**

The Advisory Council, College of Agriculture, Malaya :

The Director of Agriculture, Federation of Malaya. **(Chairman).**
The Director, Rubber Research Institute of Malaya, Kuala Lumpur.
The Principal, Sultan Idris Training College, Tanjong Malim.
The Principal, College of Agriculture, Malaya.
The Hon'ble Enche Hashim bin Awang, J.P., Tassek Glugor.
The Director, Veterinary Services, Federation of Malaya.
Secretary of the Alumni Association, College of Agriculture, Malaya.
The Hon'ble Mr. Yap Kim Hock, Johore Bahru.
Datok Jaafar bin Mampak, Dato Wangsa, Kuala Trengganu.
Mr. Chan Hin Cheung, Kuala Lumpur.
Enche Jamaludin bin Aji, Seremban.
Enche Ismail bin Yusoff, Kuala Lumpur.
The Representative of the Rubber Producers' Council.
The Registrar and Bursar, College of Agriculture, Serdang. **(Secretary).**

The Efficiency Bar Board :

The Deputy Director of Agriculture. **(Chairman).**
The Hon'ble State Secretary, Perak.
The Hon'ble State Secretary, Negri Sembilan.
The Representative of the Federal Government.
The Administrative Officer. **(Secretary).**

THE

Malayan Agricultural Journal

Vol. 41, No. 2, 1958.

EDITORIAL

Records of long service and devotion to a single occupation were formerly more common than they are today. Mr. R.G. Heath, whose retirement after more than 30 years in the Department of Agriculture is announced in these pages, set an outstanding example. It will be many years before his record of service, from probationer in 1927 to the position of Director of Agriculture at his retirement in 1958, can be repeated.

Propagation of Lowland Tea. Mr. Whitehead has contributed a well-planned account of the advantages of propagating lowland tea by means of cuttings rather than by the more usual use of seed. The production of high-quality and high-yielding bushes from seed is fraught with serious difficulties, but the selection of superior clones and their propagation by vegetative means is shown to be comparatively simple. The key to successful vegetative propagation is control of atmospheric humidity and a clear account of the technique required to achieve this under Malayan conditions forms an important section of the article.

Cocoa Drying. Cocoa drying is not a straightforward water-removal process but involves a number of factors affecting the flavour and quality of the cocoa. Mr. Haynes, who has left the Department and is now in Nigeria, conducted a series of investigations into the relative merits of different techniques used in drying cocoa. In his article the results of his work and the apparatus he designed or adapted for use in Malaya are described in detail.

Tomato-growing on padi land. There is extensive cultivation of off-season vegetable crops on about 2,000 acres of padi land near Malacca town. The authors have studied the methods used for growing tomatoes on eight Chinese farmers' holdings, and conclude that although the success of tomato growing is largely dependent on suitable weather conditions and the absence of disease, yet it is becoming more popular as an off-season crop and can provide a useful addition to the cash income of a padi farmer.

Rauwolfia. Notes on an unusual crop which has been grown with success on an experimental basis in Kuala Lumpur are contributed by Mr. Allen, formerly of this Department. The roots of *Rauwolfia serpentina*

are used in the preparation of medicinal products with a wide range of application, especially in the treatment of high blood pressure, snake bite and in "tranquillizer" drugs. Although in the past the price has been excellent, at present there are ample stocks available in India and Malayan roots are not readily marketable.

THE VEGETATIVE PROPAGATION OF TEA ON THE LOWLANDS OF MALAYA

BY

C. WHITEHEAD,

Acting Senior Agronomist

Introduction

The commercial tea plants of both the highlands and the lowlands of Malaya are mainly hybrids of Assam and Manipuri origin. Propagation is usually by seed, vegetative propagation being a relatively new feature and one which has as yet been put to very limited use in Malaya.

In Malaya, as indeed in many other countries, it is difficult to obtain seed which can be expected to produce seedlings of above average quality. Tea is almost entirely cross fertilised, hence the quality of the seedling progeny is greatly influenced by the pollen parent. Malayan seed is frequently obtained from unproven parents in nurseries which are not satisfactorily isolated. In these nurseries there is a tendency for the more freely flowering and usually poorer plants to dominate the field of pollinating parents. This can result in the production of seed of undesirable quality potential and cause a progressive deterioration of stock.

To maintain the quality of a known strain or *jat*, isolation of the seed garden and rigorous rogueing are necessary. The production of improved seed capable of producing vigorous, high yielding and high quality plants is dependent on the development of a breeding programme. Such a programme is fraught with serious difficulties and can at best be expected to produce effective results only after many years. Portsmouth (6) has pointed out that little progress in the development of clonal seed of superior quality has been made at the Tea Research Institute, Ceylon, over a period of twenty years. The difficulties encountered have led to the virtual abandonment of breeding programmes and their replacement by the selection of clonal material for vegetative propagation. Child (2) has similarly stressed the present inadequacy of seed propagation. He has stated that "vegetative propagation is the only answer" to the problem of providing improved planting material in East Africa.

The potentiality of vegetatively propagated material has been demonstrated by the Tea Research Institute of Ceylon. Yields of over three thousand pounds of made tea per acre have been achieved from such material. These are about twice the best yields expected from lowland tea in Malaya. Conservative opinion in this country has argued that the absence of a tap root in some forms of vegetatively propagated material adversely affects the growth of such plants. This has been

the subject of formal investigation on typically sandy soils in the lowlands. No significant differences in growth rate of aerial or subterranean organs of either seedlings or cuttings were found over a period of eight years, even on an area subject to periodic drought. It is considered improbable that the growth of plants developed from cuttings is in any way inferior to plants grown from seed under lowland conditions in Malaya. The potentiality of the former is far greater than the latter in the foreseeable future.

Selection of Clone Parents

The value of a vegetative propagation programme is entirely dependent on the potential capacity of the clone parents. The selection of mother bushes is therefore a most important factor. Selection is carried out from fields in plucking and should be based on yield records, morphological and physiological characteristics of the bush and quality assessment of the leaf. The procedure has been described in detail by Kehl (4) and the criteria involved are briefly summarised as follows:—

(1) Consistent high yield record. This is usually associated with vigorous growth, a low branching habit, clean frame, good spread and a dense plucking table. These associated physical characteristics may be determined visually. Care must be taken to avoid bushes with a free flowering habit, short internodes and a tendency to produce *banji* frequently (temporary dormancy of buds).

(2) Pest and disease resistance, particularly resistance to blister blight.

(3) Ease of rooting cuttings. All but the most easily rooted are discarded.

(4) High manufacturing quality. The technique of manufacturing leaf from individual bushes for the assessment of quality has been described by Keegel (3).

Note: Considerable care has to be taken to avoid selecting apparently desirable bushes when their attributes merely reflect unusual features of their immediate environment, such as position on field edges.

The selection of clone parents embodying satisfactorily the four criteria is a long and difficult task and may be beyond the capacity of individual estates. Satisfactory interim selections embodying certain of these criteria have however been achieved on an estate scale in Ceylon and elsewhere. Child (2), referring to work at Tocklai has indicated that outstanding crop yield can be obtained once in 200 trials, similarly outstanding quality can be expected once in 200 trials. It is feasible therefore that these two features may be expected to occur once in 40,000 cases or from an area of approximately 14 acres of tea. Selection on a limited basis of this sort may be within the capacity of estates in Malaya but such estates would be advised to base their selection on areas of not less than 40,000 bushes.

Vegetative Propagation Technique

An important factor restricting the use of vegetatively propagated tea in Malaya has been the difficulty in finding a satisfactory propagation technique. A number of different techniques have been developed in various parts of the world but that most frequently used today is propagation by means of internodal cuttings. This technique is used in Ceylon and is described in detail by Kehl (4). It has been tried in Malaya with variable results but has not been found to be generally satisfactory in the lowlands. A modified technique has been developed which has proved to be very satisfactory.

Production of Cutting Wood

Selected mother bushes are carefully labelled. Two labels are used, one attached to the bush and the other to a tall stake driven into the ground alongside. As a further precaution to prevent confusion in identity, the locations of the various mother bushes are marked on a site plan. The selected bushes are pruned fairly hard and manured during a suitable growing season. Shoots which develop on the pruned bushes are used as a source of cuttings. These are allowed to grow unhindered until their basal portions are well lignified. It usually takes from two to four months after pruning to achieve this. It is advantageous to cut off the shoot tips some two to three weeks before removing the cutting wood shoots. This hardens the upper portion of the shoot and stimulates development of the axillary buds.

Siting the Propagation Unit

Shade is essential. Natural vegetation is satisfactory for this purpose. Thinned jungle may be adequate; alternatively dedap, *Erythrina subumbrans*, may be planted 12 ft. square to provide a satisfactory site after a few years. *Indigofera teysmanni* provides shade more quickly. The density of shade required is similar to that provided for young cacao.

The selected site must be accessible and have a reliable supply of water. The soil should be free draining and of low pH value.

Preparation of Rooting Beds

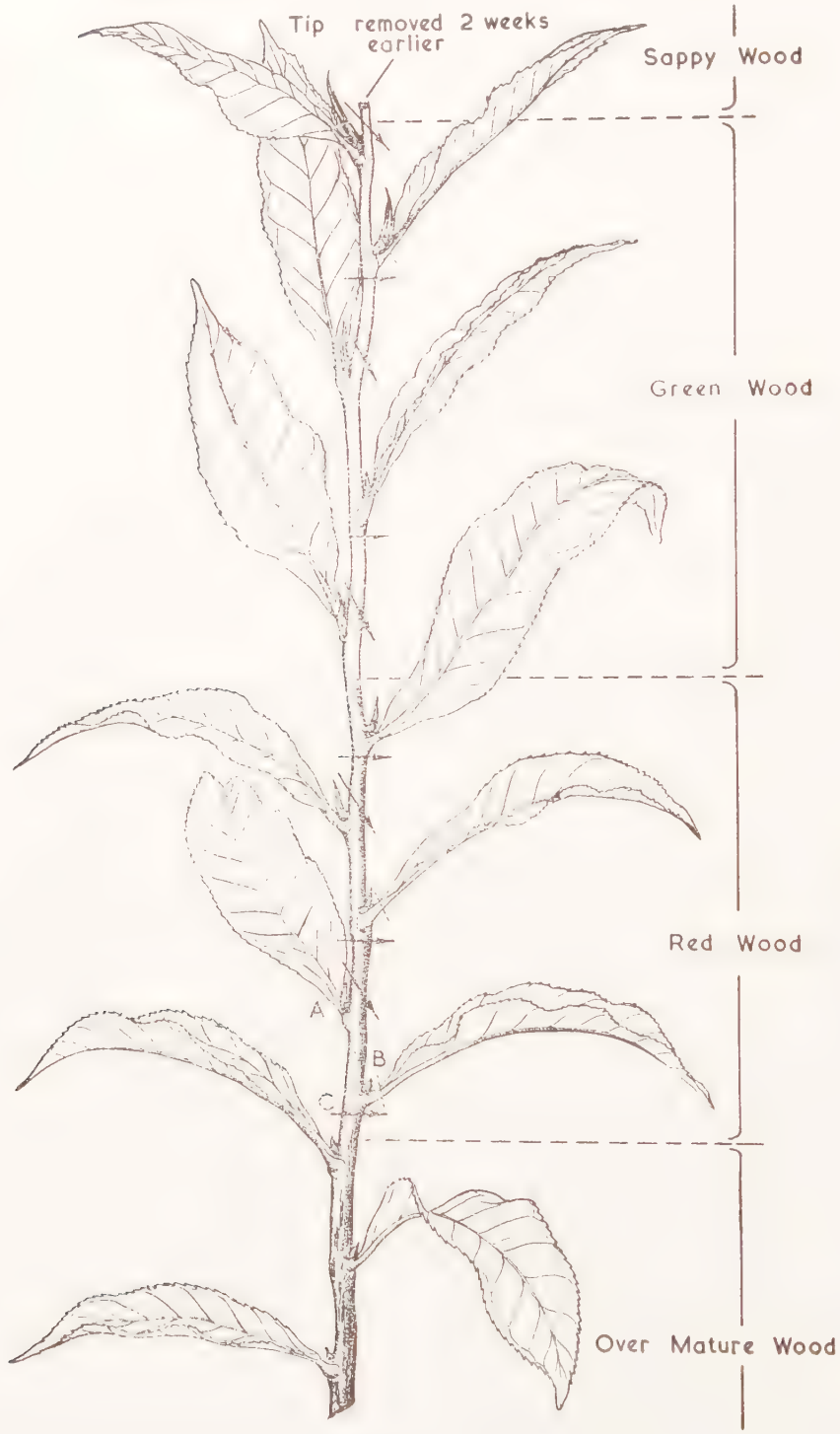
Trenches of convenient length are excavated betwen the shade trees. These should be 4 ft. wide and 9 in. deep. The soil removed is banked up along the sides and ends of the trench to form a pit of some 12 to 15 in. depth. The bottom of the pit is forked over to assist drainage and the pit filled with the rooting medium. This is prepared from the following ingredients:—

2 parts loam of medium texture.
1 part well rotted sawdust.
1 part sharp sand.

This mixture may be prepared beforehand or the ingredients may be

FIG. 1

Cutting Wood Showing Preparation of Cuttings.



Note: Bud and/or leaf removal is shown diagrammatically. In practice no projecting stumps are left.

mixed in the pit. If the latter procedure is adopted the bottom of the pit may have to be reforked to loosen the compacted soil before the rooting medium is finally placed in position. Steam sterilization of the soil carried out a few days prior to its use is advantageous. This destroys pathogenic organisms and weed seed but is not an essential feature. In no circumstances should the mixed rooting medium be steamed. If steaming is not feasible, virgin jungle top soil of low seed content is the most easily obtainable alternative.

The rooting medium should be compacted by treading on boards laid over it. The surface is then raked level and a generous application of water given with a sprinkler. It is advisable to leave the rooting bed for a day before inserting the cuttings. Immediately before inserting the cuttings a layer of dry, sharp sand ¼ in. deep should be spread over the surface of the rooting bed.

Collection of Cutting Wood

Suitable shoots on the mother bush are usually collected two or three weeks after their tips have been pruned. They are removed with secateurs or a knife, leaving a stump carrying two good buds on the bush to provide further growth. The shoots removed are placed in water in a container. Separate containers should be used for different clones, as tying the shoots in bundles may cause damage to the foliage of potential cuttings. Care must be taken in labelling containers to avoid subsequent confusion in identity. (Plates I, II).

The shoots in their containers are transferred to the shaded propagation site as quickly as possible. They are allowed to stand in the shade for a while before preparation.

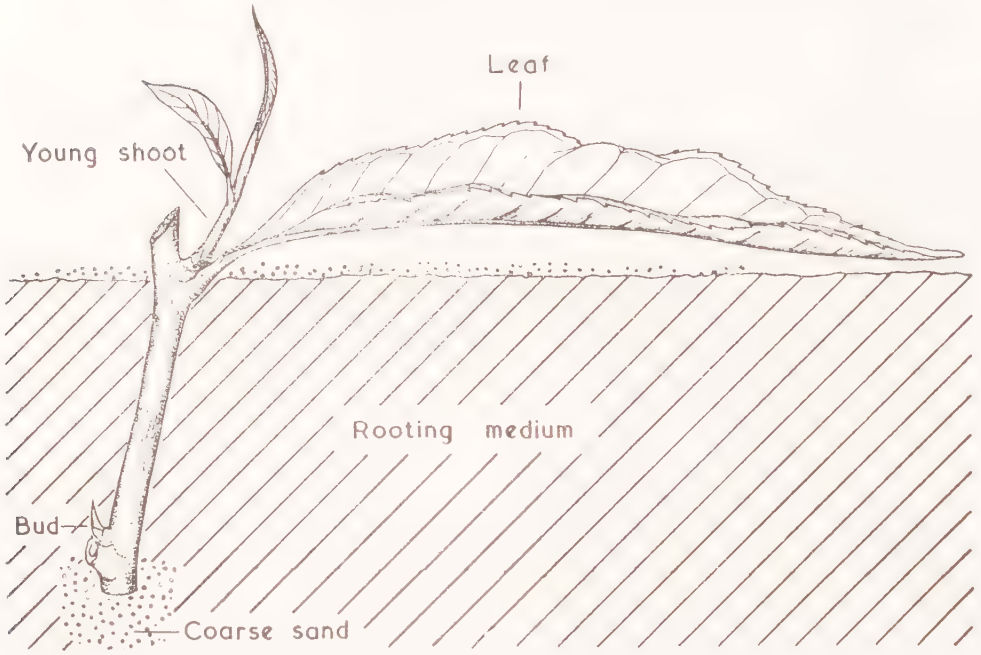
Preparation of Cuttings

Single-leaf cuttings are required, but it is considered desirable for the cuttings to possess two nodes, the base of the cutting being just below the lower, leafless node. Soft sappy wood and the heavily lignified, over-mature portions of the shoot are first removed as illustrated in Fig. I. The reddish brown and green wood remaining are used for the preparation of cuttings. A suitable bud is selected on the lower portion of the shoot as at A in Fig. I. The stem is severed immediately above it, using a sharp knife. The leaf at the node below (B in Fig. I) is removed and the stem cut just below this node (C in Fig. I). If the bud at the lower node has developed, it is removed. The prepared cutting, as illustrated in Fig. II, consists of two nodes, the upper bearing a leaf and a developing axillary bud and the lower leafless and with or without its axillary bud. The cutting is dropped into water in a shallow tray when its preparation has been completed. Further cuttings are removed from the shoot in a similar manner. The ideal cutting is one in which the upper bud is showing signs of active growth, young shoots of ½ in. to ¾ in. long being ideal. (Plate III). If growth from this bud is excessive

it may be cut back to the first leaf. No cutting should be used where this bud is either markedly dormant or is a flower bud.

FIG. 2

Diagram of Cutting Inserted in Rooting Medium.



STRIKING THE CUTTINGS

The cuttings are dibbled into the rooting medium in rows 6 in. apart. They are spaced 4 to 6 in. apart in the row and inserted so that the leaves all face the same way. (Plate IV). When more than one clone is being propagated, a space of 12 in. is left between the adjacent rows of different clones and each clone is labelled to prevent subsequent confusion in identity. When striking the cuttings the propagator works from a board placed over the rooting medium. A broad dibbler of appropriate length is used to provide a substantial hole. The dry surface sand flows into this hole and the cutting is inserted so that its base rests on this sand while its leaf lies level with the surface. The dibbler is used to close the hole, ensuring that no air pockets are left around the cutting. The surface soil is pressed around the cutting with the fingers. Care must be taken to avoid bruising the cuttings when dibbling in; bruising or peeling of the bark must be particularly guarded against.

HUMIDITY AND TEMPERATURE CONTROL

Shade trees reduce the temperature, increase the humidy and offer wind protection, but additional control of humidity in the immediate

PLATE I

Preparation of cuttings.

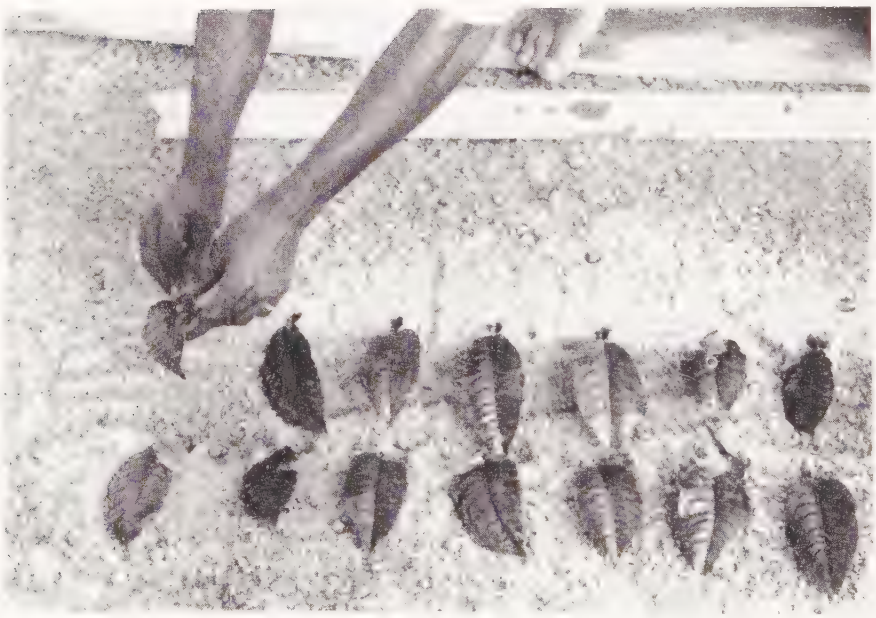
PLATE II

Prepared cuttings retained in water.

PLATE III

Single cutting.

PLATE IV



Insertion of cuttings. All cuttings facing one way.

vicinity of the cuttings is required. This may be achieved either by the periodic soaking of fronds of the fern *Gleichena linearis* which have been inserted between alternate rows of cuttings or by the construction of polythene covers over the propagating pit.

The density of fern cover required is less than that recommended for shading purposes by Kehl(4) at the Tea Research Institute, Ceylon. The fern in this case is required mainly for humidity control and this is achieved by soaking it at intervals during dry weather. The fern disintegrates in the course of time, thus gradually hardening off the cuttings. (Plate V).

Observations have suggested that rooting beds covered with polythene sheet in the form of a continuous cloche are considerably more efficient in terms of rooting success and simplicity of management than those 'shaded' with fern. Polythene sheets, joined in appropriate widths by heat-sealing, are laid over a split bamboo frame. This skeleton framework is shaped in the fashion of a Nissen hut, the main girders being embedded in the soil about 9 in. outside the edge of the pit on each side. A clamp girder is fitted over the plastic sheet at each main girder to keep it in place. The ends of the 'tunnel' so formed are sealed with separate pieces of polythene sheet. The side walls of this 'tunnel' can be lifted sufficiently to permit watering by hose-pipe. High humidity can be maintained within these tunnels and periodic soaking, as opposed to watering, is not required. (Plate VI).

There is reason to believe that the polythene cloches described can be substantially improved upon. Continuous use of the 'tunnel' arrangement can result in tearing of the polythene. The construction of a series of light rectangular frameworks covered with polythene on the pattern of the Dutch light and erected in tent fashion are at present being tried.

Management

It has been pointed out that propagating pits shaded with fern require periodic spraying with water. This should be carried out at least three times a day for the first eight to ten weeks unless weather conditions make it unnecessary. Twice-daily watering is carried out thereafter. Polythene covered pits retain their humidity more easily. Light daily watering of the cuttings is all that is normally necessary and this may be reduced at discretion. Water is most conveniently applied by a hosepipe fitted with a rose spout and water may be drawn from a static source by means of a portable pump.

The cuttings may be expected to callus six to eight weeks after being struck. They can be most easily lifted and transported at this stage, packed in moist peat or moss. Rooting generally commences some ten to sixteen weeks after striking but the time at which this takes place differs with different clones. More than ninety per cent rooting success has been achieved with a number of clones. When test sampling indicates that rooting has commenced, the fern or polythene may be

judiciously removed. Three to four weeks later, when root development is more advanced, very dilute solutions of liquid manure may be applied occasionally. Liquid animal manure or proprietary mixtures rich in phosphate are satisfactory. However, it is very important to avoid over-manuring as this may inhibit root development. Fifty pounds of cow dung to a 44-gallon oil drum of water or ½ lb. of a soluble proprietary mixture to the same amount of water, applied once a fortnight, is usually sufficient. The application should be made in 'sandwich' form, light applications of water being given immediately prior to and after the manurial solution.

'Potting Up'

The efficiency of intensive propagating units is dependent on a fairly rapid turnover. In consequence, the rooted cuttings are lifted and 'potted on' as soon as feasible. The cuttings are usually lifted twenty to twenty-four weeks after striking, thus permitting a repeat propagation within the same year. They can however be left for several months longer if so desired. When they are judged to be sufficiently rooted the young cuttings are lifted, using a transplanter or other similar device. It is most important to minimise disturbance of the root system and to retain a ball of soil around the roots. The lifted plants are immediately transferred either to baskets or, more economically in Malaya, to wood veneer tubes as described by Allen and Whitehead (1). (Plate VII).

Potting up is completed carefully, ensuring that the ball of soil around the roots is not broken. The potting mixture used for this purpose is a local adaptation of the John Innes Potting compost J.I.P. 2 developed by Lawrence and Newell (5) in the United Kingdom. Imperfectly rooted or otherwise stunted cuttings are rejected. The tubed cuttings are dipped in a pail of water to ensure that the compost is fully settled and well soaked. The plants are retained in the shaded propagation unit until fully drained. (Plate VIII).

Hardening

Plants lifted and tubed at this very early age are in a particularly delicate condition. It is of vital importance that a propagation unit operating with such a rapid turnover should be worked in conjunction with a satisfactory hardening unit. Such a unit should provide close control of the post-potting or post-tubing environment. The layout may be as elaborate or as simple as desired. (Plate X). A simple hardening unit consists of wooden bins or frames fitted with polythene frame lights under natural or artificial shade. The tubed plants are moved into the bins as quickly as possible and the cover closed. A high degree of humidity must be maintained in these bins. They are opened during the first week only to permit watering. Subsequently, the lights are raised gradually, an inch or so at a time, until they are fully open in a further 10 to 14 days. The initial hardening completed, the plants are then removed and placed in a shaded plant shed. (Plate IX). The hardening is continued at a more

PLATE V

Inserting bracken as shade over completed bed.

PLATE VI

Polythene covered propagation unit.

PLATE VII

'Potting up'

PLATE VIII

Tubed cutting

PLATE IX

Cutting 3 months after tubing.

PLATE X

An elaborate hardening unit.

PLATE XI

Clonal tea established in the field

leisurely pace by transferring the plants within the shed to areas of decreasing shade intensity and finally to open land. This latter stage in hardening is similar to that provided for some budgrafted fruit plants and the plant shed may be constructed in similar fashion. The percentage mortality of rooted cuttings which occurs between the time of tubing and planting in the field varies in accordance with the initial rooting ability of the clone. Approximately 80 per cent to 90 per cent of the successfully rooted cuttings survive the full hardening process.

Growth of plants during hardening is usually rapid. If ideal weather conditions are available it may be possible to plant rooted cuttings in the field nine months after they were taken. It is not usual however to plant cuttings until at least one year after vegetative propagation has been undertaken.

Summary

Tea is usually propagated by seed. Improved varieties can be obtained only as a result of a very long-term breeding programme. Such a programme is fraught with serious difficulties and certain authorities are of the opinion that a more satisfactory solution is the selection of superior clones and their propagation by vegetative means.

A brief description of the selection of parent material is given. It is pointed out that such improvements in Malaya have in the past been hindered by difficulties in the technique of propagation. These have been largely overcome and a detailed description of a successful vegetative propagation technique is given. The essential feature of this technique is close control of atmospheric humidity during both rooting and hardening of the cuttings.

References

(1) Allen, E.F., and Whitehead, C. (1955): "The Use of Veneer Tubes for Raising Cacao Seedlings." *Malay. agric. J.*, **38**, 92.

(2) Child, R. (1955): "Tea Seed and Vegetative Propagation." *Proc. 3rd Conf. Tea Research Institute of East Africa.*

(3) Keegel, E.L. (1953): "Vegetative Propagation of Tea—The Manufacturing Aspect." *Tea Quart.*, **24**, 82.

(4) Kehl, F.H. (1950): "Vegetative Propagation of Tea by Nodal Cuttings." *Tea Quart.*, **21**, 3.

(5) Lawrence, W.J.C., and Newell, J. (1939): Seed and Potting Composts. (London: Geo Allen and Unwin, Ltd.) 1939.

(6) Portsmouth, G.B. (1954): "Vegetative Propagation and Clonal Seed Production." *Tea Quart.*, **25**, 75.

(7) Wight, W. (1951): "Summary of Ten Years Research On The Use of Sulphate of Ammonia Under Shade." *Proc. 9th Annu. Conf. Tocklai Exp. Sta.*

COCOA DRYING

BY

D. W. M. HAYNES,

Formerly Agricultural Engineer.

Introduction

In most cocoa-growing areas the cocoa is sun-dried on drying floors or barbecues, but in Malaya the peak harvest occurs during the wet season and sun drying is unreliable; on the average about 26 days are required for drying but much longer periods have been recorded at the Federal Experiment Station, Serdang, the longest being 76 days.

Cocoa drying is not a straight-forward water-removal process. Complex chemical changes which lead to the development of the full flavour proceed during the drying period. Most authorities state that drying must be slow in order to allow the flavour to develop to the full but very slow drying allows fungal growth to develop on the outside of the beans; fungi on the exterior are not particularly objectionable, since the outer shell is discarded in processing, but an objectionable flavour is caused if the fungi enter the bean itself.

Many references to artificial drying are found in the literature on the subject but many of these are contradictory and little technical information on the design of artificial driers appears to have been published, although there is general agreement that the bean temperature should not exceed 158°F., since higher temperatures will destroy the enzymes which bring about the development of flavour. Many types of driers have been used, but the most common appears to have been the rotary driers such as the *Gaurdiola* and the more modern *Gordons* and "convection" driers without circulating fans; tray driers have also been used with various types of heat sources and it was shown with the *Chula*, in the Gold Coast, that cocoa could be dried in 14 hours at air temperatures as high as 176°F., without serious loss of quality.

In view of contradictory reports on the optimum conditions for artificial drying and of the lack of data on which to base designs, it was decided to investigate the characteristics of wet and dry cocoa, to build a small, adaptable rotary drier for investigations into different drying time/temperature combinations, and to build a general purpose, hot-air tray drier which could be used, among other things, for cocoa drying at the Federal Experiment Station, Serdang. It was also decided to build a "Cameroons Drier", a simple hot plate design, at Federal Experiment Station, Jerangau. Since a commercial cocoa estate is building a "convection" drier, it will eventually be possible to compare all the methods which have commonly been used for drying cocoa.

The Characteristics of Wet and Dry Cocoa Beans

Moisture Content

Wet cocoa beans delivered from the fermentary are surrounded by

mucilaginous pulp and have a moisture content of 52 to 59 per cent on a wet basis. In order to ensure safe storage without deterioration from fungus or insect attack it is necessary to dry the beans to 6 to 8 per cent m.c.w.b.*; it is therefore necessary to remove nearly 120 lb. of water to produce 100 lb. of dry cocoa.

Trials at Serdang have shown that loss of moisture is initially very rapid, even if the beans are not exposed to the sun. One batch of wet beans was kept in a shed on a dull day when the temperature averaged 82°F and the relative humidity was 80 per cent and was subsequently left overnight in a closed room where the temperature remained constant at 78°F and the humidity 88 per cent. During this 24 hour period the moisture content was reduced by only 3 per cent m.c.w.b., but the weight of water lost represented 11.75 per cent of the total required to reduce the moisture content to 6.25 per cent.

Weight/Volume

The weight/volume of the wet beans received for drier trials varied between 40 and 45½ lb. per cu. ft., averaging 43.8 lb. per cu. ft. The moisture content of these samples ranged from 52.0 to 59.0 per cent m.c.w.b.

The records of 30 mixed batches of cocoa sun-dried at Serdang show that the weight/volume figures varied from 31 to 36 lb. per cu. ft., averaging 35 lb. per cu. ft. The beans which were dried artificially during the tests, especially those dried slowly in the rotary drier, were plumper in appearance than sun-dried beans and ranged from 29.1 to 32.2 lb. per cu. ft., averaging 29.7 lb. per cu. ft. at an average moisture content of 6.9 per cent m.c.w.b.

Resistance to Air Flow

In order to select a suitable fan for an artificial drier it is necessary to know the resistance of the crop to air flow; curves showing the resistance of many crops have been published, e.g., in the *"Agricultural Engineers Year Book, 1955"*, but no information relating to wet or dry cocoa beans could be found in the literature and it was decided to make the necessary apparatus to measure the pressure drop across a column of cocoa at various air flows. The apparatus consisted of a sheet metal cylinder 17 in. in diameter with a perforated floor, a long air duct containing a pitot tube to measure the air flow, and a blower with an adjustable throttle on the intake to provide the necessary air flow; rings of holes in the cylinder communicated with annuli which could be connected to a simple inclined U-tube manometer which increased the true pressure difference by x 20. The pitot tube was calibrated against a Short and Mason vane anemometer but no equipment was available to check the accuracy of the manometer; the whole apparatus was therefore checked by preparing a curve for a sample of maize, adjusted to a moisture content of 12.4 per cent m.c.w.b. and

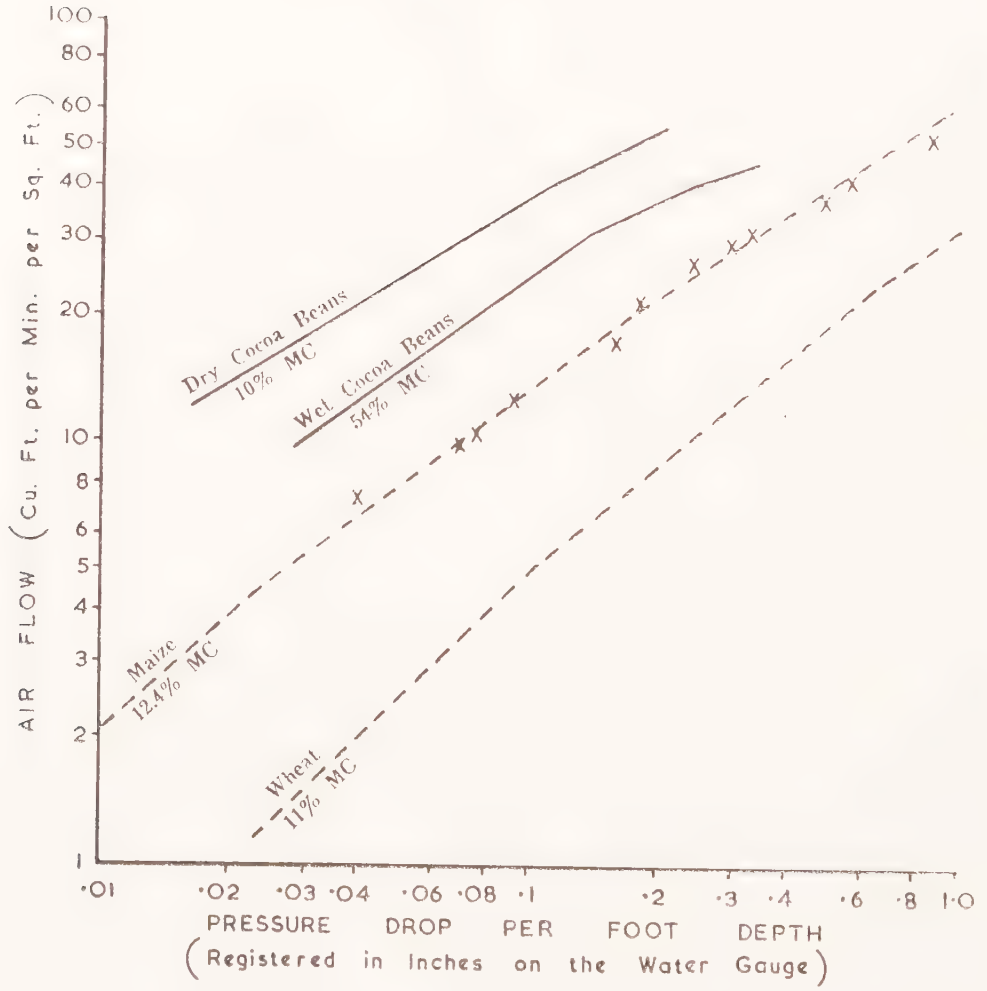
* m.c.w.b. = moisture content wet basis.

comparing the result with the published curve for a similar sample. The result of this check is included in Graph I and it will be seen that reasonably good agreement was obtained in the range of 10 to 60 cu. ft. per min. per sq. ft.

The resistance of cocoa beans to air flow, as measured in this apparatus, is shown in Graph I, which is plotted on log-log paper to give straight line curves. It will be seen that the resistance of wet beans is only about 15 per cent of that of wheat at 11 per cent m.c.w.b. and that the resistance of dry cocoa beans is only about 50

GRAPH I

RESISTANCE TO AIR FLOW



Curves for Maize and Wheat from "Agricultural Engineers Yearbook 1955".

X Calibration of Serdang apparatus with Maize.

Curves for wet and dry Cocoa Beans obtained with Serdang apparatus.

per cent of that of wet cocoa beans. It will also be seen that, provided the design of the drier is such that the beans comprise the main resistance to air flow, simple propeller fans will be quite adequate at any reasonable air flow, provided that the depth of cocoa does not exceed one foot.

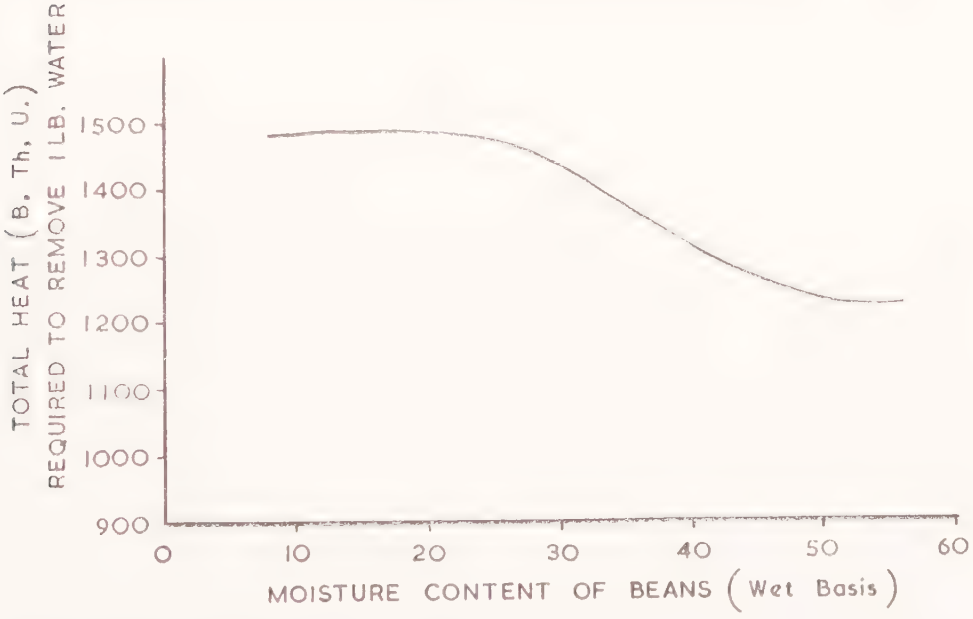
Heat of Evaporation

A simple apparatus, consisting of a well-lagged plywood tray with a perforated bottom and a simple fan and electric heater, was used to assess the heat required to evaporate 1 lb. of water. The air flow was measured by a pitot tube, which was calibrated against the vane anemometer, and duct and exhaust temperatures and humidities were measured immediately below and above the beans at 10 min. intervals. Graph II shows the total heat required to remove 1 lb. of water, including the heat required to increase the temperature of the beans and heat losses, when the duct temperature was 150°F. ±1°F., the air flow was 17.5 cu. ft. per min. per sq. ft. and the layer of beans was initially 1½ in. thick.

GRAPH II

TOTAL HEAT REQUIRED TO REMOVE 1 LB. WATER AT 150°F. WITH AN AIR FLOW OF 17.5 CU. FT. PER MIN.

(Including heat required to raise temperature of beans, heat losses, etc.)



Corrosion and Staining of Beans

During the first stage of fermentation the sugars in the pulp surrounding the beans are converted to alcohol but, as the temperature increases, the alcohol is subsequently converted to acetic acid which is given off during drying. There are many references in the literature to the need for protecting metal surfaces in and around cocoa driers.

Aluminium has been recommended as a suitable material for driers and drying-shed roofs.

In order to check the resistance of aluminium to corrosion a number of samples of different metals were buried in and suspended above cocoa which was drying in the simple tray referred to above. The aluminium was completely immune to attack from vapour, although some traces of blackening were found in scratches on the surface of samples buried in the beans. The ferrous samples were very rapidly attacked by the vapour, forming an orange rust, and buried samples were pitted and blackened. Galvanised iron samples were not corroded by the vapour or the beans, and the white crystals, which some authorities report develop when beans are in contact with galvanised surfaces, were not seen. Brass samples buried in the beans were blackened but the metal was not attacked by the vapours, while Monel metal in the form of wire cloth, was not affected by beans or vapours and remained bright and shiny.

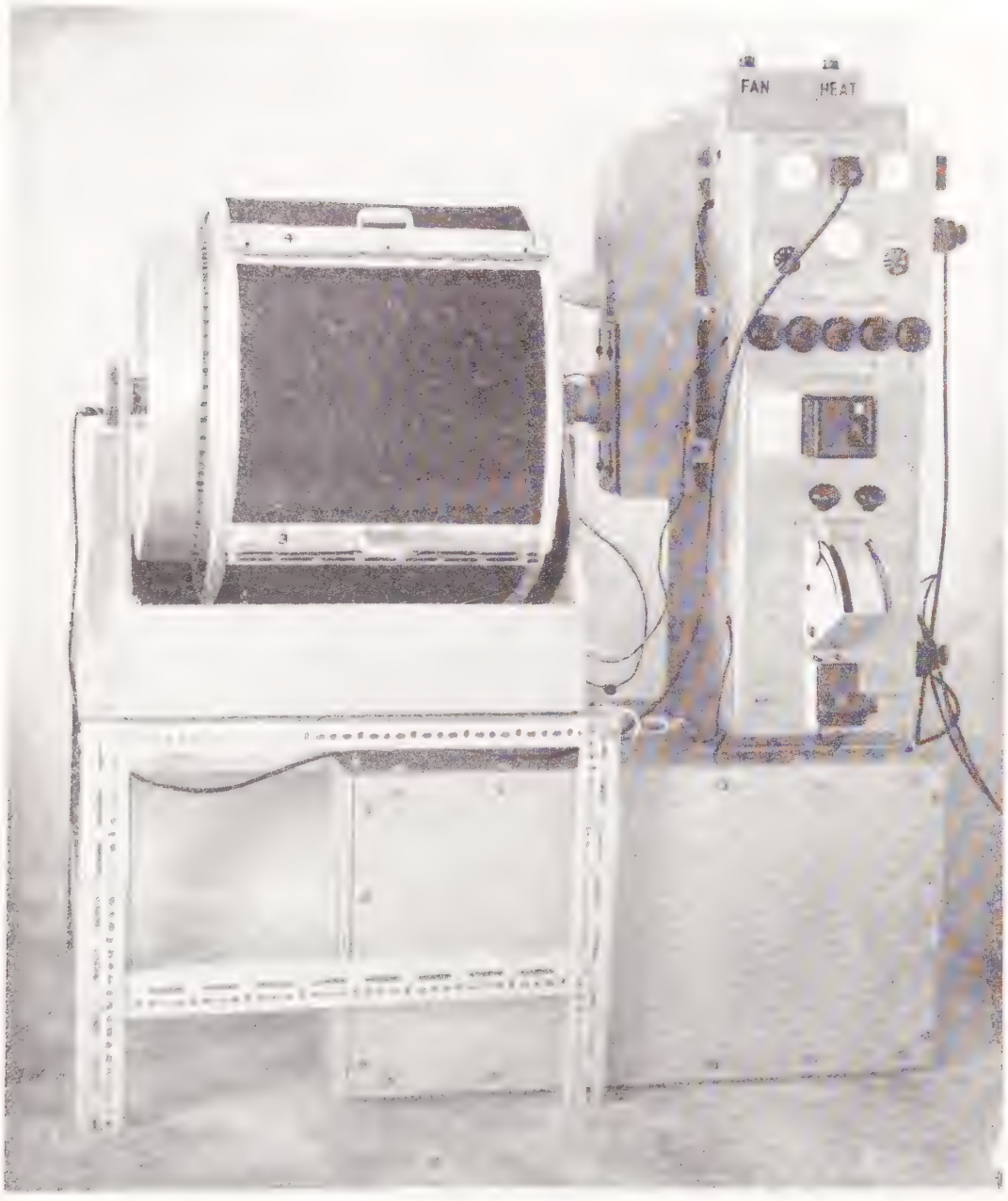
Beans which were in contact with ferrous metal samples were stained a deep blue-black colour, due to the formation of "ink" by the reaction of tannins in the bean with the iron. Beans in contact with brass showed black stains but the stains were neither so extensive nor so dense as those caused by iron.

Hot-Air Drying of Cocoa Beans

The two driers built for cocoa trials are shown in Plates I and II. The small, electrically-heated rotary drier shown in Plate I was designed for use in the Chemistry Division laboratories and is intended for small batches of cocoa. The fan, contained in the chamber under the drier, is an "Xpelair" 9 in. ventilation fan and G.E.C. tubular wardrobe heaters are mounted in the vertical box on the right of the drum. The heaters are arranged in five banks and any desired loading between 60 and 1,900 watts can be used. The air flow is controlled by two louvres and is adjustable from 0 to 60 c.f.m. The drum, which is divided into four compartments, is of welded aluminium and the covers are four-mesh Monel wire cloth. The drum is driven by an electric motor and three speeds, 1½, 2½ and 4 r.p.m., can be obtained by selecting the appropriate pulley. A G.E.C. water-heater thermostat, adjustable between 110°F. and 190°F., is fitted into the hollow drum spindle and switches the heaters directly; the thermostat can be short-circuited by a switch if it is desired to work at constant heat input rather than at constant temperature.

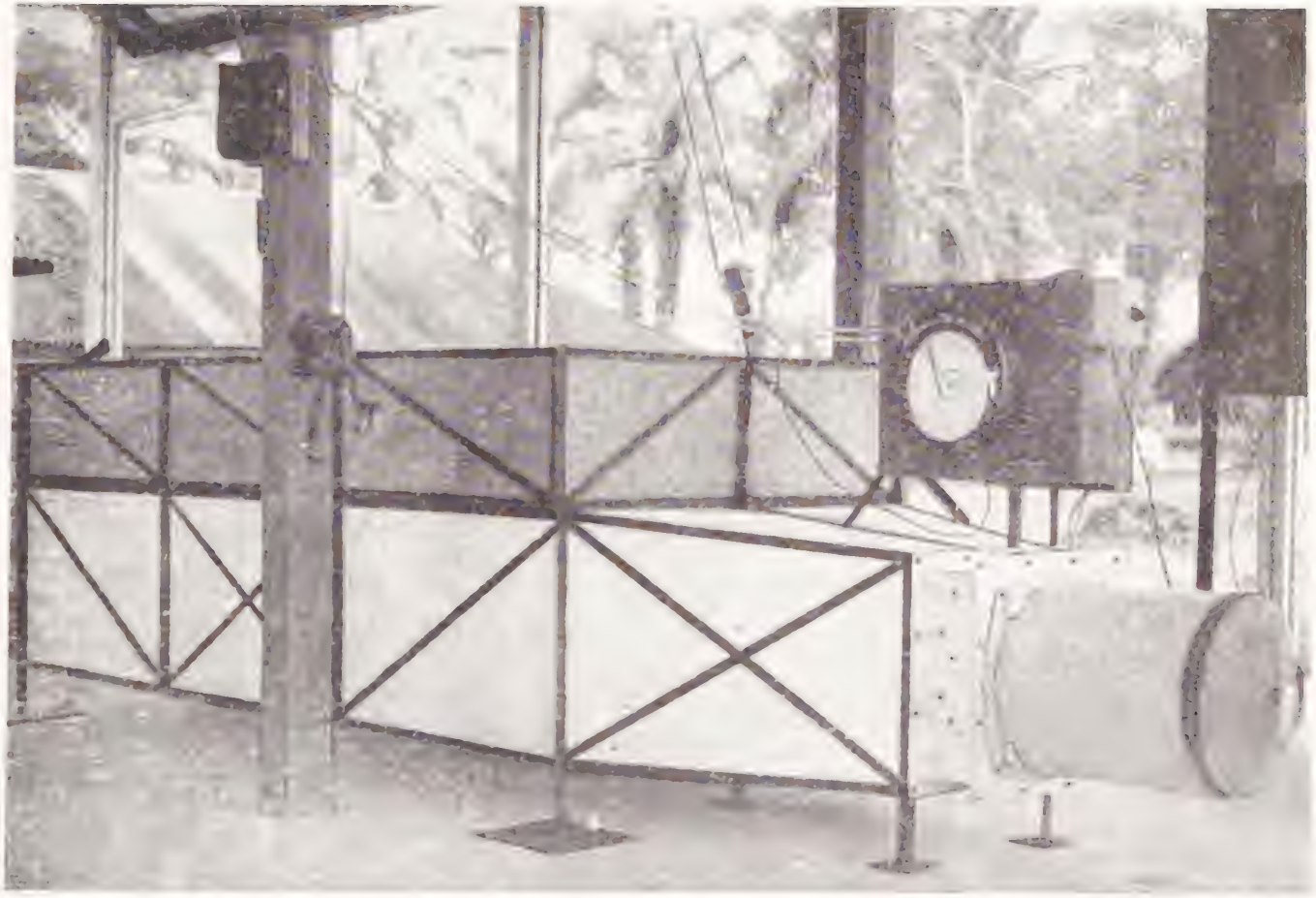
The fan and heater unit designed for the rotary drier was used in conjunction with a small temporary tray drier to determine the heat of evaporation and to obtain information on which to base the design of the full-size tray drier. The small tray, which was 2 x 1 ft. in area and 1 ft. 3 in. deep, was constructed of plywood on a slotted angle frame. The bottom of the tray was of four-mesh Monel wire cloth and the temperature was controlled by a Honeywell temperature controller, the

PLATE 1



Small electrically-heated rotary drier.

PLATE II



Simple tray drier with an area of 36 sq. ft.

bulb of which was fitted immediately under the bottom of the tray. Baffles were placed in the plenum chamber and adjusted by trial and error until the air flow, as measured with the vane anemometer, was even over the whole area of the tray and a check with a mercury-in-glass thermometer showed that the temperature did not vary by more than 2°F. between any two points.

The large tray drier shown in Plate II, is a simple tray drier with an area of 36 sq. ft.; the contents of a standard cocoa fermentary box of the type used at Seradang fill the tray to a depth of 4½ in. Electric fans and heaters have been used to reduce the capital cost. The air delivery of the Woods 15 in. propeller fan can be controlled by a regulator between about 1,400 c.f.m. and 1,250 c.f.m. The 18 in. square heater was made by General Electric Company (Malaya) Ltd. and is a 3 phase 20 kw. unit.

The frames of the plenum chamber, which is covered with ⅜ in. Asbestolux (an asbestos boarding which does not disintegrate when wet) and the tray, the sides of which are plywood, are fabricated in units from welded 1 x 1 x ⅛ in. mild steel angles. The tray is hinged to the plenum chamber and can be tipped by a wire rope led through a system of pulleys to a small hand winch; a sacking off-chute is fixed to one end of the tray and the dried material can be removed quickly from the tray. The tray was originally fitted with a four-mesh Monel wire cloth bottom on a wooden frame. This bottom was not satisfactory, as the wire sagged and the frames warped, and it will be replaced by a perforated ⅛ in. aluminium sheet bottom, supported by rivetted ribs.

The total cost of the tray drier was $1,210 including the necessary control gear, and the operating cost, at 7¼ cents per kw. hr., has averaged about 10 to 12 cents per lb. of dry cocoa when drying from 54 to 7 per cent m.c.w.b. The estimated cost of an oil-fired tray drier of similar size and performance was $7,000 and the estimated operating cost was 4 to 5 cents per lb. of dry cocoa under similar conditions.

Hot-Air Drying in the Rotary Drier

A number of trial runs were made to discover how wet cocoa beans behaved in the rotary drier; drying times have varied from 24 to 86 hr. In the first run it was found that the wet beans adhered most tenaciously to the drum walls and that the shell was broken if the beans were torn away by hand or by the tumbling action of the charge. Pre-washing of the beans to remove the pulp increased this tendency to stick, resulting in an increase in the amount of damage in one run, and also appeared to increase the damage due to germination.

Preliminary Treatment	*Percentage of Beans Damaged*	*Percentage of Germinated Beans*
No washing	2	0.76
Light washing	6	2.30
Thorough washing	7	2.46

It was found in later runs that sticking could be entirely eliminated by lining the drum with plywood, which in one run increased the drying time by 10 per cent, or by "greasing" the drum by rubbing it with a calico bag filled with ground, dry cocoa.

Dried beans from unwashed samples were of dark brown, even colour and slightly polished appearance; they were evenly covered by a fine whitish powder which showed in the latter stages of drying and appeared to be ground dry pulp. Dried washed beans were much paler brown with prominent pale veining, were highly polished, and were free from powdering. Both washed and unwashed samples were free from wrinkling although the beans were not fully plump. The shells of the washed beans were much more brittle than those of the unwashed beans, which were strengthened by the layer of dried pulp; as would be expected, the percentage shell waste after roasting was lower when the pulp had been washed away, being 12.4 per cent for washed and 16.4 per cent for unwashed beans. Although the trials were not primarily concerned with the effect of drying on flavour, samples of chocolate were prepared by the Chemistry Division from the washed and unwashed samples. As would be expected since only the shell, which is discarded, is affected by washing, there appeared to be little difference between the washed and unwashed samples.

Hot-Air Drying in the Tray Driers

Cocoa has been dried at temperatures from 130 to 160°F. at various air flows with drying times between 10 and 18 hours, both in the large tray drier shown in Plate II and in the small tray used to measure heat of evaporation.

The need for agitation or stirring was investigated in a number of runs with the small drier. Under all conditions tried it was found that there was a very marked difference in the rate of drying in the lower and upper layers of beans and that the drying time was reduced by up to 50 per cent if the beans were thoroughly mixed at hourly intervals, especially during the first four hours of drying, unless the layer of beans was less than 1½ in. thick. It was found that it was difficult to mix the beans if the layer was more than 4½ in. thick and this depth was adopted for the large tray drier. Mixing must be carried out with care since the beans are easily damaged when wet and can conveniently be done by hand, although wooden rakes and shovels have also been used.

If the warm beans from the fermentary are loaded directly into a tray drier, it is evident from the clouds of steam evolved that a considerable amount of water can be removed by blowing through unheated air. It has not yet been determined, however, whether it is more economical to use the fermentary heat in this way or to leave the beans to wilt before drying.

Beans dried in the small tray drier at temperatures from 130 to 150°F. have a plump appearance and a dark, even colour. The percentage shell waste after roasting was 14.1 per cent in one sample; 5.2 per cent

of the beans in this sample were damaged but two-thirds of this damage was attributed to rough handling prior to drying. A considerable amount of dust and trash falls through the bottom of the tray during mixing. Chocolate made by the Chemistry Division from a sample dried in 12 hours at 150°F. had a good flavour, although the beans were over-fermented.

Drier trials were somewhat restricted as a result of shortage in the supply of fermented beans from the Federal Experiment Station, Serdang. A number of small batches have been dried with the large tray drier but only one full charge of 430 lb. has become available. The drier was used as a constant heat input and not a constant temperature unit; the air-duct temperature varied between 147 and 162° F. with an air flow of approximately 35 c.f.m. per sq. ft. of tray. In these conditions drying was completed in 14 hr. and 297.5 kw. hr. of electricity were consumed; 221 lb. of water were removed and the total energy input, including power for the fan, was thus equivalent to 3,413 B. Th. U. per lb. of water evaporated. The total yield of dry cocoa was 209 lb. and the cost of power at 7¼ cents per kw. hr. was $21.56; the cost of drying was therefore 10.3 cents per lb. of dry cocoa. The dried beans were uneven in colour and had a rough surface. They smelt slightly acid and the chocolate samples prepared from these beans by the Chemistry Division were very acid in taste.

Warm-Air Drying in the Small Tray Drier

The small tray drier was used to simulate the conditions which would obtain in a small "waste-heat" drier of the type used at Serdang for in-bin drying of padi. Such a drier would be attractive on small cocoa plantations because the absence of special control equipment and heaters would reduce the initial cost and the nature of the heat source would prevent accidental damage through overheating.

In all the trials the fan was set to deliver 17.5 cu. ft. per min. per sq. ft. of tray and a heater loading of 240 watts was used to give a temperature rise of roughly 15°F. Under these conditions it was found that mixing was unnecessary and that the layer of beans could be up to 12 in. deep. In most of the runs, however, the thickness of the layer was limited by the amount of cocoa available.

In one trial run a 4 in. layer of wet cocoa was dried in 62 hours when the temperature was increased to 15°F. above the ambient temperature. The total consumption of electricity was 17.4 kw. hr. and 13¾ lb. of water were removed. The total energy input, including power for the fan, was therefore 4,342 B. Th. U. per lb. of water evaporated. During the first 30 hours however, the energy input was equivalent to only 3,493 B. Th. U. per lb. After this time the exhaust temperature was never less than 5°F. above the ambient temperature and the relative humidity of the exhaust was less than 75 per cent except for a few short periods. This exhaust heat could have been

conveniently utilized by placing a second tray over the first. The cost of drying was 8½ cents per lb. of dry cocoa.

The beans were uneven in colour and had a rough surface but were not acid, and the chocolate samples had a good flavour.

Hot Plate Drying of Cocoa Beans

The "Cameroons Drier" constructed at the Federal Experiment Station, Jerangau, is a simple hot-plate drier constructed largely from old tar barrels. Two fire tubes, consisting of three tar barrels with the tops and bottoms removed, placed end to end, were laid in trenches and covered with a layer of metal sheets formed by cutting open tar barrels and flattening the sheets out; a thick layer of sand and a protective layer of bamboo matting were placed on the metal sheets. The sand is heated by wood fires in the fire tubes and the cocoa beans are spread in a thin layer on the bamboo mats.

The "Cameroons Drier" was constructed to the design given in the extension leaflet published by the Department of Agriculture, Eastern Region, Nigeria, except that the tar barrels making up the fire tubes were welded together since it has been reported that smoke may leak from the clay joints recommended in the leaflet, causing a "hammy" taint in the cocoa. The "Cameroons Drier" was used only once during the period under review but its performance was very satisfactory.

Summary

The characteristics of wet and dry cocoa beans are discussed with reference to moisture content, weight/volume variations, resistance to air flow, heat evaporation, and the corrosion and staining of beans.

Various systems of hot and warm-air drying of beans are described and discussed. Reference is made to the satisfactory performance of the "Cameroons Drier" at the Federal Experiment Station, Jerangau.

THE CULTIVATION OF TOMATO AS AN OFF-SEASON CROP ON PADI LAND

BY

J. S. URE,
State Agricultural Officer, Malacca.

and

LIM EOW HWA,
Agricultural Assistant, Malacca.

Introduction

Around Malacca town some 2,000 acres of padi land are utilised annually in the off-season for the cultivation of vegetables. One of the most remunerative crops grown is tomatoes, and in this article the method of cultivation is described. During the 1957 off-season the activities of eight Chinese padi and vegetable farmers were observed and recorded as a basis for this description.

The holdings studied varied in size from 1½ to 12 acres, the whole acreage in each case carrying a padi crop during the padi season. Of the larger holdings, however, only part carried any vegetable crop during the off-season. The largest area of vegetables grown by one family was six acres, the more commonly grown vegetable crops being gourds, chillies, ginger, spring onions, brinjal, cucumber, long bean, turmeric, lettuce and other leaf-vegetables.

Tomatoes are grown by comparatively few cultivators and the acreage grown is never large. Only two of the holdings studied had as much as one acre of tomatoes, the others had areas of less than half an acre. The tomatoes are sometimes grown in successive years on the same area but normally they are rotated with the other off-season vegetable crops.

On seven of the eight holdings recorded the variety of padi grown was *pulut hitam*. This short-term variety allows harvesting to be completed at an earlier date than is normal for the area. Some of the holdings were harvested as early as December and in no case was harvesting later than mid-March, whereas the normal padi harvesting period for the area is from February to April.

Cultivation

Immediately after the padi harvest the straw is removed from the land, stacked for later use as a mulch on the vegetable beds, and cultivation in preparation for the vegetable crop is commenced. This consists of one or two ploughings, after which the land is allowed to weather for one to two weeks before the vegetable beds are raised. These beds are usually 3 feet wide and about 2½ feet high, and are raised by hand using a flat wooden shovel as shown in Plate I.

In the cultivation for tomatoes a nursery bed is completed first. A bed 3 feet wide and 6 feet long is required to raise the seedlings for one acre. By repeated hand cultivation as fine a tilth as possible is

achieved, after which the bed is soaked with liquid manure prepared from pig manure or night soil, though on some holdings this is not done until after the sowing of the seeds.

The seed, believed to have been brought originally from China, is no longer imported but is obtained annually from the fruit of plants selected from the previous crop and the local trade in tomato seed is negligible since the majority of farmers prefer to select and use their own seed. The fruit selected for seed production are retained on the plants until fully ripe, when they are picked and the seeds removed by hand. The seed is then thoroughly dried in the sun and stored in bottles or other insect-proof containers until required. From 7 to 10 lb. of tomatoes will give 1 oz. of seed, which is sufficient to provide seedlings for the planting of half an acre.

Prior to sowing, the tomato seed is mixed with fine sand to facilitate sowing. It is then broadcast evenly on the nursery bed and watered. Nurseries are never shaded, as it is believed by the growers that shading will weaken the seedlings and so increase the losses on transplanting. Liquid manure may be applied after the sowing of seeds, and the nursery bed is watered daily if necessary.

Transplanting is done from 12 to 20 days after sowing, by which time the plants are 2 to 3 in. high. Planting out is usually done in March or April. The planting points are prepared by mixing about 4 oz. of burnt earth with the soil at each point. Two rows 1½ feet apart are planted on each bed, the seedlings being spaced 1 ft. apart within the rows. Losses at transplanting are frequently as high as 20 per cent and are attributed to bacterial wilt. A few farmers replace the casualties but most have learnt by experience that supplying is not worthwhile, as the supplied seedlings often die.

A mulch of padi straw is used by some growers (only two of the eight recorded) in order to limit the weed growth as far as possible. The majority do not mulch the tomato beds as the mulch harbours insect pests. During the growing period daily watering is carried out if necessary and liquid manure is applied every week or 10 days. In addition prawn-dust or fish-manure is applied at the rate of about one pikul per acre (which is approximately equal to one kati per 20 yards of bed). Only one of the growers used neither prawn-dust nor fish-manure as he was of the opinion that these manures attract ants which damage the plants and fruits.

Harvesting is spread over a period of four weeks and begins about 45 days after transplanting, by which time the plant has formed a bush some 2 feet in height (Plate 2). Normally four harvesting rounds are carried out at weekly intervals, the largest and most valuable fruits being obtained from the early harvests. Occasionally heavy yielding plants require to be supported and this is done with split bamboo, but it is not usually necessary. Harvesting is invariably done when the fruit are still green. Dealers prefer to purchase the fruit at this stage as they claim that they can better withstand the bulk handling which

PLATE I

Raisong beds for tomato planting.

PLATE II

Tomatoes ready for harvesting.

PLATE III

Baskets of tomatoes being packed in the Malacca market for export to Singapore.

follows. The crop is sold to dealers in the Malacca market who, after satisfying local requirements, dispatch the balance by road to Singapore (Plate 3).

Discussion

The price obtained by the growers varied in the 1957 season from $7 to $30 per pikul and during the early part of the season an average price of $20 per pikul was obtained. The fruit are generally very small (one kati containing, on the average, some 30 fruit). The average yield recorded from four holdings was 14.75 pikuls per acre, the normal yields varying between 10 and 19 pikuls. Yields are to a large extent dependent on the weather, for extremes of rainfall or temperature greatly reduce them.

Wilt is the greatest danger to the success of the crop and no control measures are known to the cultivators. The main insect pests are caterpillars, grasshoppers and occasionally, ants. To control these pests the plants are usually sprayed with a DDT or BHC insecticide.

Though the cultivation of tomatoes is somewhat risky, the market being limited and the plants liable to disease damage, its popularity is increasing. Particularly when the tomatoes are interplanted with other crops such as lettuces, onions, or ginger, a very satisfactory return can be achieved on small holdings where all the labour for the cultivation of the padi and tomato crops is supplied by the cultivator's family. The expenditure incurred is very low, being restricted to the purchase of fertiliser and insecticide. From one acre it is estimated that, on the average, 14 pikuls of padi valued at $14 per pikul and 15 pikuls of tomatoes valued at $20 per pikul can be obtained, giving an income of about $500 per acre per year.

NOTES ON THE CULTIVATION OF RAUWOLFIA IN MALAYA

BY

E. F. ALLEN

Formerly Acting Deputy Director of Agriculture.

Introduction

For ten centuries or more the root of *Rauwolfia serpentina* has been used in Indian medicine but it is only during the last decade that its full value has been recognised in the West, where the alkaloid reserpine —one of many contained in the plant—is now extensively used in the treatment of high blood pressure and as an ingredient in tranquillizing drugs.

Both *R. serpentina* and the indigenous plant *R. perakensis* have been cultivated on an experimental scale in Kuala Lumpur and this paper describes early results.

Botany

The genus *Rauwolfia*, of the family *Apocyanaceae*, is of widespread occurrence throughout the tropics and over one hundred species have been described. In Malaya two species have been recorded, *R. perakensis* King and Gamble, which is a shrub and *R. sumatrana* Jack, a rare tree which has been collected twice from limestone hills in the Kinta district of Perak. Short descriptions of the two species which have been brought into local cultivation are given below.

R. perakensis

A shrub, usually 4 to 6 ft. high and 3 to 4 ft. across, although it is said to grow up to 10 ft. high. The elliptic, pointed leaves are usually about 6 x 2 in. and arranged in whorls of three.

Inflorescences are long-stalked, diffuse cymes. The calyx is green and inconspicuous with five narrow, pointed sepals; the corolla tube is pale pink, ¾ in. long, with a limb of five white petals about 1/3 in. wide. The fruit is a drupe divided to the base into two short, bluntly-pointed, thinly-pulpy pods, green at first but ripening red and finally black with a conspicuous grey bloom.

R. serpentina

A dwarf shrub in cultivation, woody at the base and lactiferous, growing 2 to 3 ft. high. The elliptic or obovate leaves are 4 to 9 in. long by 1 to 2½ in. wide and arranged in whorls of three, the uppermost nodes often very short.

The flower buds and calyx are white, tinged pink at first; the corolla tubes are pinkish violet and the petals pure white above. Later,

in fruit, the whole inflorescence turns a conspicuous bright red. The pair of pods which make up each fruit are joined together from their base to more than half their length. These fruit are green at first but later glossy black with no trace of bloom.

Two varieties are in cultivation; they can be distinguished by the following characteristics:—

1. var. *Burma:* cymes dense; leaves clustered towards the top of the stems, elliptic-obovate and up to 9 x 2½ in. in size; stems upright and unbranched or branched at ground level only.
2. var. *Ceylon:* cymes lax; leaves many and mostly about 4½ x 1½ in. in size and elliptic in shape; stems spreading and branched freely.

The roots from both varieties are similar but those of the Burma variety are usually somewhat thicker. At one time I thought that these differences would justify specific rank, but Mr. J. Sinclair, Keeper of the Herbarium at the Botanic Gardens, Singapore, considers them to come within the range of variation of *R. serpentina*.

Distribution

R. perakensis has been recorded from southern Thailand, south through Kedah, Perak and Selangor, east to northern Pahang and north to Trengganu and Kelantan. It is particularly common on the banks of the Sungei * Kelantan between Salor and Tanah Merah and it is also conspicuous in kampongs (villages) along the banks of the Sungei Besut in northern Trengganu.

R. serpentina has a discontinuous distribution from Ceylon through the Indian sub-continent to the foot of the Himalayas, east to Sikkim and Assam and south through Pegu to Tennasserim. It has not been recorded in Malaya but occurs in Java.

Soil and Manures

Both species can be cultivated in any well-drained, friable soil such as is most favourable for the cultivation of sweet potatoes. Heavy clays, shallow soils with a hard pan and coarse sands would all be unsuitable, as would any badly drained soil. Neither species has been grown on peat soils.

The specific fertiliser requirements of the crop are not known but it appears to benefit from heavy dressings of well-rotted cattle manure or compost augmented by rock phosphate, with top dressings of sulphate of ammonia given during growth. If potash fertilisers are used they should be given in moderation since *R. serpentina* in particular has been found to be very sensitive to magnesium deficiency, which causes severe chlorosis. This disorder responds slowly to dressings of kieserite. It has not been noted in *R. perakensis*.

* Sungei = River.

Propagation

Both species grow easily from seed although germination of locally raised seed has been found to be uneven, possibly due to the lack of a pronounced dry season in Kuala Lumpur. It is normally convenient to sow in boxes or pans of a good seed compost at a spacing of 1 x 1 in. and a depth of ¼ to ½ in. Germination will commence after about two weeks and when the seedlings are 1 to 2 in. tall they should be pricked out either into a nursery bed or into veneer tubes, pots or planting baskets.

Seedlings are ready for planting out when they are 12 to 18 in. tall, at which stage they will be about 1½ to 2 months old from the date of germination.

Seedling stumps of *R. perakensis* are easy to establish but *R. serpentina* appears to be somewhat less vigorous.

Planting and Cultivation

Both species can be grown on ridged beds or, where drainage is good, on the flat. Suitable planting distances are:—

R. perakensis—3 x 3 ft. or 3 x 4 ft.

R. serpentina—1½ x 2 ft.

Regular weeding is required after planting but this can be minimised by a surface mulch of lalang leaves, padi straw or any other suitable material. *R. perakensis* is a strong grower and soon shades out weeds but neither variety of *R. serpentina* is so leafy and vigorous. However, top dressings of sulphate of ammonia given after weeding will help the plants to develop a vigorous crown of leaves.

Plants of *R. serpentina* commence to flower about one month after transplanting while the local species flowers first when about six months old. Thereafter plants of both species appear always to be in flower in Kuala Lumpur.

Harvest and Yields

Only very limited figures are available on which to base an estimate of the optimum maturation period. This is because so few plants of either species have been cultivated. The figures for *R. perakensis* are summarised in Table I.

Table I

Yield of Dried Roots from *R. perakensis*

Type of Material	Date of			Approximate age (*years*)	Weight of dried roots	Yield per plant of dried roots (*oz.*)
	sowing	planting	harvesting			
5 seedling stumps	—	13.2.54	15.8.55	1½	2 lb. 4 oz.	7.2
7 seedlings	13.2.54	1.4.54	27.3.56	2	9 lb. 4 oz.	21.1
8 „	„	„	26.3.57	3	16 lb. 6 oz.	32.8

PLATE I

Rauwolfia serpentina. Burma variety.

PLATE II

Rauwolfia serpentina, Ceylon variety.

PLATE III

Dried root of the Burma variety of *R. serpentina*.

It will be seen that the available evidence suggests that the optimum age for harvesting plants of *R. perakensis* is not less than three years. In the case of the three-year-old material this was separated into roots of pencil size or larger and into finer grades. Actual weights were as follows:—

	Weight of fresh root		*Weight of dried root*		*Dry weight per cent*
	lb.	*oz.*	*lb.*	*oz.*	
Large	25	8	13	12	53.9
Fine	8	2	2	10	32.3
Total	33	10	16	6	48.7

No comparable figures for *R. serpentina* are available since this species has been in cultivation in Malaya only since March, 1956. However, yields of root for the first harvest are given in Table II.

Table II

Yield of Fresh and Dried Root of *R. serpentina*

Variety	Material	Date of sowing	Date of planting	Date of harvesting	Yield of fresh root	Yield of dried root	Yield of dried root per plant (oz.)
Burma	51 seedlings	3.3.56	23.6.56	23.8.57	17 lb.	5 lb. 10 oz.	1.76
Ceylon	14 ,,	16.3.56	22.6.56	23.8.57	1 lb. 12 oz.	8 oz.	0.57

Other crops of *R. serpentina* are available for harvesting when two and three years old, so it will be possible to make an estimate of optimum maturation period. Indian research workers (1) have suggested that two and three year-old crops should give a yield of 2,000 and 3,000 lb. of air-dry root respectively. This estimate is based on an average yield per two year-old plant of 45.05 gm. (1.59 oz.) of air-dry root whereas Malayan-grown plants of the Burma variety have yielded 49.9 gm. (1.76 oz.) at 14 months from planting out. This suggests that yields in Malaya will be of the same order as those obtained in India where a somewhat closer spacing of 1 x 2 ft. is recommended.

Pests and Diseases

No pests and diseases have been noted in Malaya nor do birds eat the ripe fruits. Doubtless the alkaloids present in all parts of the plant make it distasteful to animal and insect pests.

Chlorosis in the leaves of *R. serpentina* is often followed by necrotic spotting, but this is apparently caused by magnesium deficiency.

Uses

Preparations derived from the root of *R. serpentina* have been used both in Europe and America as hypotensive and hypnotic drugs (1).

In India the drug has been in use for many centuries and it is official in the Indian Pharmaceutical Codex. In the present century it gained renown as a hypotensive drug because Mahatma Gandhi is said to have taken it regularly in small doses against high blood pressure. Latterly, however, the drug has come into some disfavour (3) but the morbid tendencies noted have been known for years and do not merit the alarmist headlines accorded them in the daily press.

Some 15 alkaloids have been isolated from the roots of *R. sepentina* (4) but reserpine is said to be the chief active ingredient. The drug is marketed both in crude form and as a crystalline extract.

R. perakensis is not at present used in medicine although local workers have isolated the alkaloids reserpine, *iso*-reserpiline and sarpagine from its roots (2). One commercial report suggests that reserpine is present in amounts too small to be of commercial value (5).

Extracts from the roots of both species have been used both in India and Malaya as an antidote against snake bite.

Current Demand

There is no commercial demand for roots of *R. perakensis* at present, although considerable quantities have been supplied to research workers in several countries during the last seven years.

In the past few years there have been very keen demands from manufacturing pharmaceutical chemists and their agents for dried roots of *R. serpentina*. In 1953 one firm asked for five to ten tons per year while in 1954 another firm quoted their approximate requirements as 30 to 50 tons. Latterly, however, we have been unable to sell small quantities, apparently because most firms dealing with the drug have adequate stocks of Indian origin. This is a most disappointing state of affairs, especially since extremely high prices were quoted for the extract as recently as December, 1955.

It seems clear that commercial cultivation of *Rauwolfia* is not at present justified, although it could be brought into cultivation at very short notice. The future demand for the drug will be watched with great interest.

Summary

The experimental cultivation of *R. perakensis* and *R. serpentina* in Malaya is described. Both species are easy to cultivate on well-drained soil.

Research workers have shown a keen interest in supplies of root of *R. perakensis* during the last seven years but there is no commercial demand.

Root of *R. serpentina* has been in very keen commercial demand in recent years as it is used to prepare anti-hypertensive, hypnotic and tranquillizing drugs.

At the time of writing there is no demand for root of *R. serpentina* and commercial cultivation cannot at present be recommended.

References

(1) Badhwar, R.L., Karira, G.V. and Ramaswami, S. (1955): "*Rauwolfia serpentina*—The Wonder Drug of India". *Indian For.*, **81**, 258.
(2) Kiang, A.K. (1957): Private communication.
(3) Kyneur, F.J. (1957): "Psychiatric Consequences of Rauwolfia Therapy." *Med. J. Aust.* **2** (7), 44th year, 241.
(4) Monachino, J. (1954): "*Rauwolfia serpentina*—Its History, Botany and Medical Use." *Econ. Bot.* **8**, 349.
(5) Penick, S.B., and Co. (1954): Private communication.

MASTER FARMERS OF MALAYA, VII.
TUAN SEMBOK

BY

MOHAMAD BIN JAMIL

State Agricultural Officer, Trengganu.

Introduction

Keen observation, lots of common sense and business shrewdness, backed by pioneering spirit, have not only convinced Tuan Sembok of the wealth in Mandarin oranges but also placed him as a leading smallholder in Trengganu. Perhaps, considering the fastidiousness of orange cultivation, in which only the skilled Chinese agriculturalists of Lower Perak and Segamat have so far excelled, Tuan Sembok may have claim to be the best Malay orange grower in the Federation.

The story of Tuan Sembok (his real name is Syed Abdul Rahman bin Syed Mohamad Al-Idrus) and his oranges, is very well known in and around Kuala Trengganu and started in 1935. Young then and only recently married, he came to stay with his parents at the village of Chabang Tiga outside Kuala Trengganu. In the compound of his father's house there was an old Mandarin orange tree which produced heavy crops of good quality fruit. This tree he reckoned could produce about 1,000 fruits a year, and at a price of $2 per 100 fruit, should provide an income of $20 from the tree in a year. A plot of 100 trees, he thought, could therefore produce a return of approximately $2,000 a year.

Although the calculation of income was theoretical, he was convinced that orange growing was a practical and paying proposition. He was the more convinced about this because of the possibility of his monopolising the local orange market. It did not therefore take him long to decide on a trial, and soon he bought a piece of padi land about half an acre in area next to the *kampong* (village), at a price of $80.

Cultivation Methods

Even in this early stage of a new and unknown venture Tuan Sembok displayed his gifted sense of good agricultural practices. The field, which was ploughed by animal drawn implements, was turned into a series of equally spaced mounds of about 4 ft. width at the beginning, but later extended to 10 ft. at maturity of the trees. When the normal planting season period started, rooted Mandarin orange marcots were planted on the mounds and the lower part of the field between the mounds was planted with padi. Planting materials were obtained from the original tree.

With such a display of skill in crop husbandry nothing could be expected but a successful establishment of 100 vigorous Mandarin orange trees. The plants were manured with ash and fish refuse. After the first year there was a light crop of fruits and, much to the satisfaction

of Tuan Sembok, these were of the same quality as those from the parent tree. The crop of padi (he had only one crop) gave a very high yield of 200 *gantangs* for the limited space planted, i.e. equivalent to over 400 *gantangs* per acre.

Tuan Sembok then became more and more confident in his new venture. Very wisely he used the padi straw for mulching the trees, and daily he gained experience in the necessary maintenance work. His neighbours, who at the beginning frowned on the idea, began to change their minds. The holding became well known and more and more persons visited the area, but none yet appeared to be sufficiently interested to follow Tuan Sembok's example.

When the plants were about 2 years old there was a serious drought which caused Tuan Sembok some concern. However, with his expert care and attention the crop survived and flowered at about 2½ years old. Each tree bore from 300—500 fruit and every tree in the holding fruited. There was no difficulty in selling the fruit as the holding was daily visited by customers. The price of fruit obtained was on the average $3 per hundred.

Income

News of the success then spread very quickly and the interest aroused resulted in many orders being placed for his marcots. During that year about $1,000 was realised from the sale of marcots alone. Thus confident in the crop Tuan Sembok decided on a larger scale of production. With the money he earned from the first plot he bought himself 10 acres of land at Bukit Payong, 9½ miles from Kuala Trengganu on the road to Kuala Brang, for $700. Planting materials were then produced from the first plot and the whole of the 10 acres of new land was planted with 2,000 plants. Once this new area was established he sold his first plot for $700. His gross income from the fruits and marcots together with the selling price of the orchard was $7,000 in 3 years.

Like his first plot, the second orchard was well established and maintained. At the age of 3 years the trees bore fruit and his fruit harvest sold at from $2 to $3 per 100 fruit. About 3 months after he started to sell the fruit from this area, the Federation was occupied by the Japanese and soon Japanese soldiers were around the place. When they took away his car in which he used to travel between his house in Kuala Trengganu and the orchard, he was unable to give the orchard the regular attention it required. The Japanese soldiers frequently damaged the trees and as a result, Tuan Sembok sold the holding for a mere $2,400.

He was thus out of a job during the period of occupation and he remained in Kuala Trengganu doing odd business. At the same time he continued to maintain a few trees round the house. With the reoccupation in 1945 he went into the trade of cloth printing, and at the same time continued with the production of planting materials from his existing trees and planted about half an acre around the house. Even with such

a small area he found that the income from oranges was more than from his trade. His heart and soul had already found a place in oranges.

With the money he earned from the trees around his house, he made another bid. An old *dusun* planted with rubber and of about 4 acres in area, at the 18th milestone, Kuala Brang Road, opposite Ajil Agricultural Station, was purchased in 1956. In reply to an enquiry by a Senior Agricultural Officer, who visited the holding during the course of development, as to why he did not replant the land with clonal rubber, Tuan Sembok politely replied that he had great faith in oranges and he was planting the area with oranges using the money obtained from oranges; oranges gave an income much earlier than rubber. Tuan Sembok knew this from his own experience.

Maintenance of Holding

This new area was opened up in 1956 and was planted in the same year. Today the plants, after about 17 months of establishment, are healthy looking and very vigorous. The trees are almost uniform in growth, between 6—7 ft. high and are planted at 20 x 13 ft., with a tree in the centre giving a triangular planting pattern. About 1,000 trees are well established in the whole area and a few have already fruited. The trees, though not pruned so far, are trained into a uniform shape. This is done by subjecting some branches of each tree to the strain of wire tied to logs or pegs.

The holding is maintained at a very high standard. Weeding is an essential practice and the whole area is clean weeded at regular intervals. The trees lack no manure, for manuring with ash and fish refuse is the normal practice. Shallow drains are provided to remove rain water rapidly and with the undulating topography of the area soil erosion is likely to take place in the absence of ground cover, but this does not appear to worry Tuan Sembok. During the early stage of establishment a crop of brinjal was inter-planted and gave a fairly substantial return.

At 17 months old, Tuan Sembok has spent already $8 per tree and he expects to get a minimum of $10 per tree from the first harvest at about 2½ years old. Maintenance work until the first harvest is not expected to cost more than $2 per tree. But he also expects to get some fruit before the first major harvest.

Tuan Sembok, being a progressive type of farmer, is always interested in new ideas and willing to put them into practice. He has set aside a small area of his present holding to conduct a fertilizer observation. He is conscious of the danger of aphids causing destruction to growing buds, and with a chemical insecticide recommended by the Department of Agriculture he carries out pest control diligently. He is quite aware of the existence and the danger of *gummosis* (foot rot) and is conversant with the treatment for affected trees. There is nothing, so far, to prevent him from making a big income from the holding.

PLATE I

View of the orange holding belonging to Tuan Sembok
Kuala Brang Road, Ulu Trengganu.

PLATE II

One of Tuan Sembok's heavy bearing orange trees at Chabang
Tiga, Kuala Trengganu.

PLATE III

Good-sized oranges at the Chabang Tiga holding, Kuala Trengganu.

Discussion

The Mandarin orange plot belonging to Tuan Sembok at Ajil, stands today as a symbol of his conviction in the value of the crop, and as a challenge and an eye-opener to others. To the Department it is a useful demonstration for extension and advisory work and in this particular respect the holding could be no better sited than where it is now. Tuan Sembok has gladly placed his holdings at the service of the Department for instructional visits.

To the would-be orange cultivators Tuan Sembok always emphasizes that there is money in Mandarin oranges but this money will come only with the expenditure of labour, patience and persistence. Not only is his advice always available but he will also undertake to supply planting materials. Initiative and hard work are the key-notes to Tuan Sembok's success.

NOTES ON CURRENT INVESTIGATIONS AND EXTENSION WORK

January to March, 1958.

Weather

Weather conditions generally on the west coast were dry with light showers during the quarter. Monsoon rains continued into February on the east coast, causing floods in Pahang.

RESEARCH

Padi

Varietal experiments have been harvested in most areas except Selangor. Stem borer damage was negligible and *penyakit merah* was absent in all the experiments. Harvesting conditions, especially in the main padi experiment stations, Telok Chengai, Pulau Gedong and Titi Serong, have been exceptionally good.

At Telok Chengai the Siam selections have given promising results over the three years under trial. The best of the selections, Siam 16 and Siam 25 gave 20 per cent better yields than Siam 29, the control. These two selections are also stronger strawed than Siam 29 and lodged less In another trial of eight Sarawak varieties at Telok Chengai, first year results showed that Engkatek gave the highest yield.

At Bukit Merah the cross Serendah Kuning x Pebifun gave 2,474 lb. per acre. The average progeny plot yields of twelve families under selection at this station was 1,459 lb. per acre.

Investigations into the control of padi stem borers have continued. Results of five field insecticidal spraying experiments have so far been received and these show that, though borer attack was in all cases light, an increased yield was obtained by spraying at intervals of two weeks throughout the growing season. Such spraying would not be economic but the results indicate that even when borer attack appears negligible the insects do cause some loss in yield. Spraying once at the optimum time (four weeks before flowering) did not result in a significant increase in yield in any of the experiments.

The survey of padi areas to assess the severity of borer attack was extended into Kelantan and Trengganu. As was general on the west coast borer incidence in these states was low, the average percentage of tillers attacked being 1.2 in Kelantan and 1.0 in Trengganu. On the other hand very heavy borer attack occurred in the Parit Satu peat area of Selangor and the most seriously affected area had 54 per cent of the tillers bored. The mean number of tillers affected at all sampling points was 26 per cent. In other parts of the Tanjong Karang area attack was extremely low.

Work on sand culture experiments to elucidate the problem of *penyakit merah* have continued. High levels of chelated iron (30 p.p.m. and 60 p.p.m. Fe) did not induce the leaf symptoms of *penyakit merah.*

In tank experiments yields of grain from plots using thirty-day old seedlings were significantly higher than those using sixty-day old seedlings. Using either age of seedlings a higher yield was given where dry cultivation had taken place in the off-season.

Agronomic Investigations and Extension

Padi harvesting was in progress in all States during the quarter. Yields in Kedah and Perlis have been lower than the previous season's as a result of the early onset of dry weather at the end of November. Increased yields, however, were harvested in Province Wellesley, Kelantan, Perak and Malacca due to favourable weather conditions. Average yields were obtained in Selangor and Negri Sembilan, but in Pahang crops were adversely affected by floods—approximately 2,350 acres having been severely damaged.

Nursery management and nursery manurial demonstrations using ammonium phosphate carried out on padi cultivators' land in all States, have shown the benefits of improved nursery methods. From an outlay of $3 per acre on purchase of ammonium phosphate for manuring nurseries, increased padi yields of from 30 to over 100 gantangs per acre have been obtained, which is equivalent to an increased income of $20 to more than $60 per acre.

Large numbers of field manuring demonstrations laid down throughout the country have also shown increased yields ranging from 30 gantangs to 100 gantangs per acre.

In Krian, the selected variety Seraup 50 has outyielded local varieties in extension trials, and in East Pahang the varieties Serendah Kuning 5029 and 5031 have given encouraging results in trials.

Two padi seed farms in Malacca produced a total of 763 pikuls of seed padi—600 pikuls of Nachin 5057 and 163 pikuls of Serendah Kuning 5003. This seed will be distributed to padi cultivators next season, and is sufficient in quantity for planting about 4,000 acres. The contractors operating seed farms were paid $18 a pikul for seed padi. Careful rogueing of the crop was carried out by Departmental staff during the growing period, and the seed padi was examined for purity, ripeness and cleaness before acceptance.

Demonstrations were continued in Trengganu and Kelantan in a campaign to encourage the use of *sabit* (sickle) and *tong banting* (threshing tub) in harvesting practice in place of the traditional *tuai* (small knife). In Kelantan, it is estimated that 70 per cent of the padi cultivators now use sickle and threshing tub as compared with only 20 per cent two seasons ago.

Three straw balers were operating in Kelantan during the harvesting period to assist farmers in baling padi straw for cattle fodder and bedding. Demonstrations of straw baling machines have also been arranged in other States.

The Kedah Padi Planters Board continued its activities in the redemption of mortgages (*jual janji*) and usufructuary loans (*gadaian*)

and the purchase of padi land for resale to members of the Padi Planters Association. During the quarter the area of padi land redeemed and/or bought and resold amounted to over 580 *relongs* (approximately 410 acres). The number of registered members of the Padi Planters Association in Kedah was 42,726 at the end of the quarter. At a meeting at the end of March, the Perlis Padi Planters Board decided to redeem *jual janji* and provide loans for the purchase of buffaloes and fertilizers for padi.

Prices paid for padi at mills in Kedah ranged from $15 to $15.80 per pikul for the varieties Radin and Intan. In Perlis the prices at mill were between $14.80 and $15.60 per pikul. In Tanjong Karang, Selangor Cooperative Societies successfully organized padi purchase in the field, and arranged bulk sale to licensed commercial millers. The cultivators received up to $13.50 per pikul for good dry padi. Cultivators in Malacca received as low as $11 per pikul during the peak harvesting period; at the end of the quarter the price had increased to $13.60 per pikul. Substantial quantities of Malacca padi were purchased by Kuala Lumpur rice mills.

7,650 acres of lowland dry padi harvested in Trengganu produced an average yield of 175 gantangs per acre; the average yield from 21,400 acres harvested in Kelantan was 183 gantangs per acre. An area of 150 acres planted with lowland dry padi in the Tanah Merah district of Kelantan yielded an average of 260 gantangs per acre, and a progressive farmer in Kota Bharu district obtained a yield of 600 gantangs per acre from his land.

Harvesting of upland dry padi in Kelantan was completed in February. From an area of 7,200 acres harvested in Tanah Merah and Ulu Kelantan districts, an average yield of 305 gantangs per acre was obtained. In other States the average yields per acre obtained were Perlis 278 gantangs, Perak 160 gantangs, Trengganu 157 gantangs and Kedah 122 gantangs per acre.

Harvesting of various agronomic trials has been completed during the quarter. Considerable care and attention has been paid to the new extension trials carried out on cultivators' land in Kedah. These trials are scattered over three areas each lying wholly in a known soil type. It is hoped that this siting will provide a means of eliminating variation due to differences in soil type.

The yield of padi at the mechanisation scheme at Parit was much as had been anticipated. Overall yield was low as a result of water shortage during the growing season but some very interesting results were obtained from those fields least affected by drought. In one field where adequate water had been provided, growth was outstandingly good but the crop had lodged badly prior to harvest and a very low yield was obtained. A three acre field which on the other hand had suffered only mildy from drought yielded 460 gantangs per acre. It is generally considered that once sufficient water is provided for efficient utilization it should be possible to grow a good crop using mechanical equipment.

Rubber

The ban on export of all types of clonal seed was lifted on 16th January, 1958.

Over 31 million clonal seed were purchased from approved sources in the 1957 seed-fall season, and established in nurseries extending to over 550 acres throughout the country to meet smallholders estimated requirements for clonal seedling stumps in the 1958/59 planting season. The use of budwood has increased in popularity among smallholders undertaking replanting, particularly in Johore. Under Departmental supervision a total area of 84 acres of rubber budwood nurseries was established at the end of the quarter, and a further area of 18 acres planted but still to be budded.

Distribution of planting materials to rubber smallholders during the quarter for replanting and new planting amounted to 44,010 yards of budwood and 527,295 clonal seedling stumps.

Alienation of land for new planting of rubber totalled 1,500 acres in Kedah and 2,500 acres in Pahang during the quarter.

Oil Palm

Poor germination in the seed bed, due to unknown causes, has limited the distribution of seedlings to host estates; only 320 have been sent to each of the four centres during the quarter. Pollen from the Serdang *pisiferas* has been sent to host estates for the *tenera* breeding programme.

Results of progeny trials from two estates have been summarised; in one of these estates two trials (1951 planting) of Dumpy and Dumpy backcross palms are in progress. The mean yield from the Dumpies is slightly greater than that of the backcrossed Dumpy palms and yield and bunch size of the Dumpy families are as a whole far more uniform.

A severe and widespread attack by *Marasmius palmivorus* which caused rotting of the fruit bunches occurred on an estate in Selangor. Control is being obtained by severe pruning of affected trees and burning of diseased parts together with prophylactic spraying with copper fungicide, but eradication of the disease is rendered difficult because of the common occurrence of the fungus on oil palm debris on the ground.

Coconut

Self-pollinations of the selected palms at Port Swettenham have been continued but the set of nuts has been disappointing. This is probably due to the present unavoidably poor condition of the palms.

Investigations into the unidentified disease of coconuts in the Batu Pahat area of Johore have been continued. An attempt was made to discover by culturing whether the disease is caused by a fungus or bacterium. Cultures were made from tissues taken from different levels of the stem of a diseased palm and also from the roots, but no pathogenic organism was isolated.

When the disease was first observed last year it was thought to be of recent origin, as only small isolated groups of affected palms surrounded by healthy palms had been reported. On a recent visit to the area typical diseased palms were seen on the edge of large spaces in which the coconuts had been killed in the past. This appears to indicate that the disease has been present for some considerable time. 25 holdings have been selected for observation to obtain information on the rate of spread and other aspects of the disease.

Prices for smallholders copra have remained generally steady in most localities and ranged between $24 to $27 per pikul.

Manurial demonstration plots using organic manures and inorganic fertilizers on poor soils in Kelantan, Trengganu and Pahang continue to show improved appearance in colour of fronds and flowering as compared with unmanured palms.

Progeny trials at the F.E.S., Telok Bharu, in Lower Perak, were maintained and some new plantings were carried out. Land proposed for planting in 1959 was surveyed in preparation for clearing later in the year.

An area of recently planted palms on an estate in the same district was inspected with a view to laying down a manurial observation. The site was considered to be suitable but implementation of proposals is held in abeyance as a result of staff shortage.

Coffee

Interest in coffee planting on a small scale has continued in Johore and Malacca. 4,300 coffee seedlings were distributed from Agricultural Stations during the quarter.

Cacao

A survey of cacao observation plots in Perak was carried out during the quarter. There are 92 smallholder plots in existence, 9 on estates and 6 Departmental areas. Smallholder plots in the riverine areas and Bagan Datoh delta continue to make good progress. A scheme has been initiated to purchase pods from smallholders and to arrange fermentation of beans either locally or at Serdang.

Squirrel damage at the Departmental plot at Bukit Gantang, Perak, has been heavy, but 500 pods were harvested in March. Growth continued to be satisfactory at the Selama Station plot, Perak, and 600 pods were harvested during the quarter.

The general health of cacao in agronomic trials at the F.E.S., Jerangau, has gradually improved. It is thought that the improvement is due mainly to the use of dressings of limestone which have corrected the deficiency of calcium in the soil. Investigations to date have to some extent clarified the problems involved in growing cacao in Malaya and these have been summarized during the quarter. It is now suspected that the majority of Malayan soils are too acid to support healthy cacao unless suitably treated. Calcium is the most obviously deficient element

and shortage of this nutrient appears to have resulted in the development of an improper calcium: potash ratio in the foliage. It is also thought that manganese and iron ratios are unbalanced and that aluminium may be present at toxic levels. Clarification of these issues would now be reasonably straightforward but further investigation must be delayed because of the impending departure on retirement of the cacao agronomist.

Pineapple

Reduction of the fixed price for fruit to 2.5 cent per lb. has caused considerable hardship to pineapple smallgrowers in Johore, and extensive areas have been abandoned due to uneconomic returns. By mid-February all canneries were working at capacity; at the end of the quarter the rate of rejection of smallgrowers fruit at the canneries exceeded 40 per cent.

Due to low returns, the use of fertilizers by pineapple smallgrowers has declined and the Pekan Nanas Cooperative Society supplied only 20 tons of fertilizers to members during the quarter.

The majority of pineapple agronomic trials at the F.E.S., Jalan Kebun, were terminated during the quarter and future investigations will be carried out by the MPIB.

Patchouli

In Central Johore harvesting of this crop continued, but no increase in planted acreage occurred. Prices of dried leaves varied between $58 per pikul for 1st grade to $25 per pikul for 3rd grade. All four kilns in Kluang district ceased operations during the quarter due to the fall in price of the product.

Fruit

Foot rot (*Phytophthora parasitica*) continues to cause serious losses of Mandarin oranges on low-lying heavy soils in the Telok Anson area. It is suspected that the disease is also present in Malacca where several trees with typical symptoms were found. Owing, however, to the prevailing dry weather the disease was quiescent and the fungus could not be isolated to confirm the cause of disease. As the disease appears to be most common on the poorly drained alluvial soils where a considerable quantity of Mandarin oranges are grown, it may assume serious proportions and investigations into the use of budded plants on resistant root stocks are being started.

Cultural methods of control, including pruning from the collar region and application of copper fungicides, have been advised.

A total of 9,175 fruit plants were sold from Departmental Stations during the quarter, and in addition 2,615 plants were distributed by recognised commercial fruit nurseries, through the Department.

Madarin oranges were in season in Perak and sold for $15 to $30 per pikul depending on grade of fruit. Interest in planting new areas with Mandarin orange has been reported from Malacca and Selangor.

1,700 seedlings of *limau chembol* and budded grape-fruit plants of clone GF5 have been raised for planting in observation and demonstration blocks on smallholders' land in Kedah.

In March, the Department in Penang started operating a service to deliver budded fruit plants, leaflets, rat poisons, etc., by lorry to the more remote rural areas. Villages were visited in Province Wellesley North and South and the service received an encouraging reception.

Tea

The collection of tea clones at the F.E.S., Serdang, has been maintained and some additional material has been planted. Experiments at the F.E.S., Cameron Highlands, have been continued.

Tobacco

Harvesting of the second crop of the year in Upper Perak was completed during the quarter. Prices for cured leaf were $140 to $180 per pikul for Grade I, $100 to $130 per pikul for Grade II, and $40 to $60 per pikul for Grade III. These prices are generally lower in all grades than those of the previous quarter.

Livestock

Pigs

Departmental sales of stock totalled 37 boars and 53 gilts. In addition 352 services were recorded at new village stud centres and 28 at Departmental stud farms.

Shortage of young stock due to an outbreak of disease in Penang during the latter part of 1957, led to increased prices for porkers and weaners in that State. Comparative prices (in dollars per *pikul*) for the 4th quarter 1957 and current quarter are shown in the following table:—

	4th quarter 1957	*1st quarter 1958*
Porkers	$102 — $106	$110 — $112
Weaners	$160 — $180	$190 — $200

Poultry

Sales for breeding purposes from Departmental Stations have totalled 63 cockerels, 80 pullets, 12 chicks and 608 hatching eggs. In addition, 14,823 eggs were sold for consumption.

Commercial hatcheries in various States continued to produce and distribute substantial numbers of day-old stock. For example, hatcheries in Kedah sold 150,000 chicks and 50,000 ducklings; Krian hatcheries, 396,000 chicks and 291,000 ducklings at prices ranging from $23 to $25 per 100; Malacca, 43,000 chicks and 30,000 ducklings at prices of $25 to $26 per 100.

Goats

Sales amounted to 14 bucks and 13 does.

Vegetables

An experiment on the control of the diamond back moth (*Plutella maculipennis* Curt.) by spraying with diazinon and malathion has been completed at Cameron Highlands. The insecticides were applied at two concentrations and at intervals of one or two weeks. Incidence of the pest during the experiment, which was carried out during wet weather, was low and only two treatments, (diazinon at either concentration applied at fortnightly intervals) gave significant increase in yield over the untreated plots. The experiment is being repeated.

In another experiment at Cameron Highlands, excellent control of flea beetles (*Phyllotreta sinuata* Steph.) on *pak choy* seedlings was obtained by spraying with diazinon. Malathion also gave good results.

Soil Surveys

In the soil survey of the Kedah plain, five tractors with power driven augers and an increased survey staff were at work to speed up the rate of survey. In certain areas, for example Padang Hang, the soil pattern is very complicated and progress was slow.

A number of sites in central and north Perak, Province Wellesley and Kedah were visited in connection with soil sampling for the pot and field trials which are being carried out for *penyakit merah* investigations.

In an attempt to obtain some indication of the nature of the soil-forming processes at work in Malayan soils, a start has been made in sampling the very deep profiles which are readily available in road cuttings. A profile taken from a new road cutting near Kuala Lumpur was sampled to a depth of about nine feet, nineteen separate samples being taken. A comprehensive series of analyses is being carried out on these samples.

Plots in *sawahs* at Sekinchang and Sungei Burong were soil sampled during the padi growing season to study the amounts of available nitrogen present. There is some indication that less nitrogen is available when the water is deep (one to two feet) than when it is shallow (four to six inches). Samples taken about fifteen days after the padi has been transplanted gave an average of 11 p.p.m. available nitrogen in the samples from Sungei Burong where the water was deep, and an average of 45 p.p.m. in the samples from Sekinchang where the water was shallow. There was a very marked difference in growth between the plants in these two areas.

Plant Diseases

An observation trial to discover whether bacterial wilt (*Pseudomonas solanacearum*) of tobacco could be controlled by flooding the soil for a period, has been carried out using tomato as the test crop. Half the experimental area was flood-fallowed for two months while the other half was not. All the tomatoes planted on the untreated soil were killed by wilt within five weeks of being transplanted, whereas in the area which had been flooded several survived and produced fruit.

Trials with organic mercurial seed dressings and with a fungicide containing captan have indicated that germination of soya bean seed can be improved by these treatments. Similar trials indicated that the germination of ground nuts can also be improved. Thiram was effective for long beans.

Several new host records for the widespread and destructive fungus *Corticium solani* have been made. Leaf rots were caused on ramie, mint, *Phaseolus aureus* and the weeds *Phyllanthus niruri, Digitaria marginata, Brachiaria paspaloides* and *Cyperus rotundus.* Damping-off occurred on *Celosis plumosa.*

Education

Newsletters

Four issues of newsletters were made during the quarter, three in Malay (Penang, Kelantan and Trengganu) and one in Chinese (Penang). Over 30,000 copies were issued.

Training Centres

A total of 302 persons attended courses at Rural Agricultural Training Centres in ten States. During the quarter the new training centre at Sungei Udang was officially opened by H.E. the Governor of Malacca, and the centre at Ajil was opened by H.H. the Yang Di-pertuan Muda, Trengganu.

During the quarter 132 school boys completed a training course on wet padi cultivation held at Bukit Merah Padi Station in Province Wellesley. At the same station a padi course was held for eight *Ketua Kampong.*

At Cheras Agricultural Station, Selangor, two ex-Malay Regiment soldiers received practical training in poultry management and fruit orchard maintenance for a period of three months. A similar course on rubber and fruit was arranged at Gajah Mati Agricultural Station in Kedah for a Malay ex-soldier.

A Ministry of Agriculture Travelling Exhibition on nutrition visited three villages in Perlis in February and subsequently three villages in the Kubang Pasu district of Kedah in March, in conjunction with community development schemes.

Development Schemes

At Ayer Lanas, Ulu Kelantan, good progress has been maintained The 400 settlers have been occupied throughout the quarter in felling and clearing the 1,200 acres of jungle due to be planted with rubber later in the year.

The area for a land development scheme in Besut, Trengganu, has been surveyed, and a manager appointed.

A proposed rubber/padi development scheme for Endau, Johore, has been submitted to the Federal Land Development Authority for approval.

In Malacca, 11,500 clonal seedling stumps and 100 lb. of inoculated cover crop seed were supplied to the Nyalas Road Scheme; plans for the Kemendore Scheme have been finalized—the first stage of this scheme will involve opening up 1,000 acres for rubber, fruit and padi; planning of the Solok Menggong Scheme is well advanced—about 600 acres will be developed under rubber and 400 acres for padi.

40 additional rubber lots were allotted during the quarter in the Bukit Tembaga Scheme in Kedah, bringing the total number of settlers to 85. Clearing in preparation for planting in August/September has commenced.

REVIEW

Handbook of Biological Data

Edited by William S. Spector, **Pp** *xxvi + 584. (W.B. Saunders Company, Philadelphia & London, 1956) $7.50 (U.S.)*

This handbook fulfills the need for a quick and ready reference on established findings in biological sciences. It may be said that it will prove as useful to biologists as the "Table of Physical Constants" is to Chemists and Physicists.

A glance at the contents gives one an idea of the immense number of facts which have been assembled by the 4041 contributors and reviewers. Such widely differing topics as 'the freezing point of sheep digestive fluids', 'the pathways of nucleo-protein katabolism' and 'the depth of water extraction of mature plant roots' give an impression of the scope of this handbook.

The typescript is small and is very trying to the eyes after a short time. This is not a serious fault because the book will generally be studied only as a reference. One obvious critism is the tabulation of plants and animals by American vernacular names instead of by the universally accepted Latin nomenclature.

This handbook is just a beginning; and is restricted in many of its facts to those applicable to temperate regions. I imagine that the inclusion of data from tropical plants and animals would cause expansion to a second volume.

The book has unlimited possibilities and should be on the shelf of all biological libraries.

F.B.B.

STAFF NOTES

(Period 31st March—30th June, 1958)

Appointments

The following appointments have been made:—

Name	*Appointed or Posted as*	*Date*
Che Basir bin Ismail	State Agricultural Officer, Trengganu	1.4.58
Che Mohamad bin Jamil	Agricultural Officer, Headquarters	1.4.58
P.G. Coleman	Acting Director of Agriculture	1.5.58
A.L. Barcroft	Acting Deputy Director of Agriculture	1.5.58
H.D. Matheson	Acting Assistant Director (Field)	1.5.58
A. Johnston	Acting Assistant Director (Research)	26.5.58

Retirements

The following officer proceeded on leave prior to retirement:—

Name & Rank	*Date*
R.G. Heath, Director of Agriculture	30.4.58

The following officer proceeded on leave prior to retirement under the Tenth Schedule to the Federation of Malaya Agreement (Amendment No. 4) Ordinance, 1956:—

Name & Rank	*Date*
C.R. Raper, Agronomist, Trengganu	24.4.58

Leave

The following officers have proceeded on leave:—

Name & Rank	*Date*
G.S. Keeping, State Agricultural Officer, Johore	28.4.58
J.K. Coulter, Acting Assistant Director (Research)	25.5.58
P. Class, Acting State Agricultural Officer, Pahang	28.5.58
T.R. Dickinson, Acting State Agricultural Officer, Perak.	7.6.58

The following officers have returned from leave:—

Name & Rank	*Date*
G.F. Darnell, Agricultural Officer, Selangor	9.4.58
G.I.M. Martin, Agronomist (North)	14.4.58

Notes on Retiring Officers

Mr. R. G. Heath

The departure on leave prior to retirement in May, 1958, of Mr. R. G. Heath, Director of Agriculture, marked the end of an era, this being the last occasion on which a non-domiciled officer of the Department will have been able to retire on age-limit.

Mr. Heath joined the Department in 1927 and for the next twenty-one years served in practically every State and Settlement, including

Singapore. In 1948 he was appointed Chief Field Officer and in the succeeding ten years held senior administrative appointments at Headquarters culminating in his substantive appointment as Director of Agriculture in June, 1955.

Mr. Heath's long and wide experience in the Field Branch was unique and enabled him to speak authoritatively and from personal experience on almost every agricultural topic and about nearly every *kampong* which might be mentioned.

Perhaps his most remarkable attribute was his almost uncanny memory for names and thumbnail biographies of every member of the Department, past or present, senior or junior and he delighted in rolling off the full Christian names or '*bins*' of his officers—the longer the better.

In his more youthful days Mr. Heath was a keen sportsman and represented various States at rugger, cricket and in particular hockey; he continued to be an enthusiastic follower of sports when he was no longer able to participate actively.

During the War, Mr. Heath served with the F.M.S.V.F. and was later attached as Liaison Officer to the 18th Division; he was taken prisoner of war on the fall of Singapore and was later sent to the Siam/Burma Railway, being one of the fortunate survivors of that infamous episode.

The Department as a whole will be the poorer for Mr. Heath's departure and will sadly miss the benefit of his experience and guidance.

Mrs. Heath, who is well known for her long association with the Girl Guide movement in Malaya, latterly as Commissioner for the Federation of Malaya, has always interested herself in the welfare of the wives and families of all members of the Department and she and Mr. Heath will be long remembered for their kindness and friendliness.

We wish them both a long and happy retirement.

STATISTICS

January to March, 1958

Rubber.—The price of rubber, as quoted by the Singapore Chamber of Commerce Rubber Association, has remained fairly steady throughout the first quarter of the year; the monthly average prices for International Type 1 (R.S.S.1) being 78.06, 77.51, 77.38 cents per pound f.o.b. for January, February and March respectively.

The report on operations by the Chief Planting Officer, the Rubber Industry (Replanting) Board, for 1957, states that progress during the year exceeded expectations. A total of 187,335 acres has been replanted under the Government scheme for smallholders since 1953, of which 52,141 acres were replanted in 1957. Replanted or new planted rubber is only eligible for grant if approved high-yielding planting material is used. A considerable acreage has also been replanted by smallholders outside the scheme.

Copra.—The copra price showed a slight improvement during the period, but total production was below the same quarter in 1957. It is interesting to note that although the copra price for January to March was around $26 per pikul in 1956, $27—28 in 1957 and $30—33 in 1958, production over the same period has declined each year.

Coffee.—Prices were uncertain during the quarter, fluctuating between $150 to $160 per pikul paid by dealers at Klang, Selangor (Table IV).

Table I

AVERAGE MONTHLY PRICES PAID BY LOCAL DEALERS FOR SMALLHOLDERS' RUBBER, JANUARY TO MARCH, 1958

(dollars per pikul*)

Grades	Alor Star, Kedah			Seremban, Negri Sembilan			Johore Bahru, Johore		
	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
Smoked Sheet No. 1	89.36	89.32	88.90	89.96	89.88	89.42	89.77	89.49	89.13
Smoked Sheet No. 2	82.36	80.27	78.40	82.76	79.93	78.74	82.97	80.04	78.92

* 1 pikul = 133⅓ lb.

This table has been compiled from statistics supplied by the Chief Statistician, Federation of Malaya.

Table II

RUBBER PRODUCTION
FEDERATION OF MALAYA

(long tons, dry weight)

Month	Estates		Smallholdings (Estimated)		Total	
	1957	1958	1957	1958	1957	1958
January -	36,070	35,800	27,184	25,400	63,260	61,200
February -	27,002	28,800	21,998	22,900	49,000	51,700
March -	25,908	28,400	20,915	20,300	46,823	48,700
April -	26,501		22,460		48,961	
May -	27,129		18,305		45,434	
June -	29,628		21,583		51,211	
July -	32,405		24,054		57,459	
August -	32,957		23,119		56,076	
September -	31,418		21,374		52,792	
October -	33,290		22,462		55,752	
November -	34,369		22,594		56,963	
December -	32,390		21,976		54,366	
Total -	369,073		268,024		637,097	
Total 1956 -	352,233		273,368		625,601	

This table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

Production on smallholdings (estates of less than 100 acres) is taken as the total of purchases from smallholders reported by licensed dealers.

Table III

AVERAGE PRICES PAID IN LONDON FOR TEA

(s.d. per lb.)

For the Week Ending	Malayan		Ceylon		Indonesian		India				Africa	
							Northern		Southern			
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
2.1.58	3	4.22	5	10.56		Nil	4	4.77	3	8.58	3	5.09
9.1.58	3	3.54	5	10.23	3	10.25	4	7.92	3	9.48	3	6.43
16.1.58	4	5.75	5	7.22		Nil	4	8.53	5	11.45	3	7.18
23.1.58	4	0.20	5	5.37		Nil	4	7.58	4	0.87	3	8.19
30.1.58	4	0.09	5	2.69	3	5.04	4	5.40	3	10.96	3	6.51
6.2.58	4	6.04	4	10.93	3	6.93	4	5.33	3	9.51	3	5.48
13.2.58	3	8.08	4	9.28	3	5.87	4	4.28	3	11.47	3	7.63
21.2.58	3	6.74	4	8.44	3	3.93	4	3.83	3	10.68	3	8.72
28.2.58	3	11.00	4	8.36	3	6.55	4	4.52	3	9.54	3	7.22
7.3.58	3	11.20	4	10.46	3	4.84	4	5.94	3	10.22	2	5.96
14.3.58	3	8.93	4	10.94		Nil	4	8.65	3	10.44	3	4.87
21.3.58		Nil	5	11.96	3	2.60	4	8.61	3	11.58	3	2.77
28.3.58		Nil	5	0.47	3	6.32	4	9.59	4	2.58	3	3.45

Table IV

AVERAGE DEALERS' PRICES FOR DRIED LIBERICAN COFFEE BEANS GROWN IN SELANGOR*

(dollars per pikul †)

For the Week Ending	Klang	Kuala Langat
	$	$
3-5-58	156.00	158.00
10-5-58	156.00	156.00
17-5-58	158.00	160.00
24-5-58	155.00	155.00
31-5-58	156.00	155.00
7-6-58	152.00	155.00
14-6-58	150.00	152.00
21-6-58	154.00	152.00
28-6-58	155.00	152.00
5-7-58	155.00	154.00
12-7-58	160.00	160.00

* These are not the prices paid to smallholders, who sell freshly harvested berries to dealers for processing.

† 1 pikul = 133⅓ lb.

Table V

PRODUCTION OF PALM OIL AND KERNELS AND PRICES OF PALM OIL

(long tons, as declared by estates)

Month	Production of Palm Oil (long tons)		Production of Palm Kernels (long tons)		Average Price per Ton of Palm Oil *
	1957	1958	1957	1958	1958
					£ s. d.
January -	3,527	3,581	921	981	77 14 0
February -	3,572	4,460	926	1,192	78 2 0
March -	4,828	6,090	1,225	1,645	80 7 0
April -	4,585	5,748	1,168	1,552	78 14 0
May -	4,689		1,096		
June -	5,140		1,203		
July -	5,823		1,480		
August -	5,355		1,445		
September -	5,666		1,408		
October -	5,896		1,465		
November -	5,070		1,341		
December -	5,356		1,103		
Total -	58,507		14,781		

* F.O.B.

Table VI

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE
FEDERATION OF MALAYA

(tons)

Month	Copra Production						Coconut Oil Production *		Copra Cake (Poonac) Manufactured	
	Estates		Smallholdings (estimated)		Total		Oil Mills		Oil Mills	
	1957	1958	1957	1958	1957	1958	1957	1958	1957	1958
January	2,473	2,449	8,454	1,857	10,927	4,306	8,272	8,164	5,160	5,136
February	2,339	2,546	5,916	8,100	8,255	10,646	7,919	5,458	4,803	3,397
March	2,725	2,895	5,510	7,028	8,235	9,923	8,677	7,032	5,340	4,469
April	2,848	2,910	6,975	—	9,824	—	6,618	6,032	4,245	3,905
May	3,098		8,185		11,283		6,614		4,163	
June	3,513		7,235		10,748		8,541		5,405	
July	4,105		10,456		14,561		8,879		5,649	
August	3,488		10,865		14,353		8,775		5,528	
September	3,195		7,948		11,143		8,704		5,470	
October	2,880		9,935		12,815		9,174		5,753	
November	2,591		5,285		7,876		8,347		5,231	
December	2,587		7,671		10,258		5,988		3,941	
Total	35,843		94,435		130,278		96,508		60,688	

Notes:—1. The above table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills, respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

* Includes both refined and crude oil.

Table VII

SINGAPORE PRICES OF VARIOUS AGRICULTURAL PRODUCTS

(dollars per pikul †)

Date	Copra, Sundried	Coconut Oil *	Pepper, F.A.Q. Muntok White	Pepper, Gen. Muntok White	Gambier, Cube	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
4-2-58	30.50	49.00	102.00	112.00	53.00	9.00	17.00	13.00
10-2-58	30.00	49.50	102.50	112.50	53.00	9.00	17.00	12.75
17-2-58	30.00	49.50	103.00	113.00	53.00	9.00	17.00	13.25
24-2-58	30.50	49.50	106.00	116.00	53.00	9.00	17.00	13.50
3-3-58	33.00	51.50	104.00	114.00	50.00	9.00	17.00	13.50
10-3-58	32.00	51.50	104.50	114.50	50.00	9.50	18.00	14.50
17-3-58	32.00	52.50	108.50	118.50	53.00	9.50	18.00	15.50
24-3-58	33.00	52.50	139.00	149.00	53.00	9.50	18.00	14.50
31-3-58	33.00	49.50	130.00	140.00	53.00	9.00	18.00	15.00
8-4-58	33.00	49.50	126.00	136.00	53.00	9.25	18.00	14.00
14-4-58	32.50	49.00	131.00	141.00	50.00	9.12	18.00	14.00
22-4-58	32.50	14.00	133.00	143.00	53.00	9.12	19.00	14.00

† 1 pikul = 133⅓ lb.

* F.O.B. in second-hand drums.

‡ Nominal.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce.

Table VIII

MALAYAN AGRICULTURAL EXPORTS, JANUARY TO DECEMBER, 1957

Product	Net Exports in Tons		
	Year 1955	Year 1956	Year 1957
Arecanuts	13,679	11,228	9,625
Coconuts, fresh †	72,140	34,779	37,466
Coconut oil	91,176	103,132	100,031
Copra	75,076 *	82,549 *	71,718 *
Copra cake	56,404 *	66,174 *	73,208 *
Gambier, all kinds	66	96	3
Palm Oil	52,832	55,252	56,728
Pineapples, canned	27,756	30,377	37,671
Sago, flour	23,053	21,483	19,581
Sago, pearl	5,483	4,276	4,021
Sago, raw	18,709 *	18,522 *	14,006 *
Tapioca, flake	475	260	403
Tapioca, flour	3,979 *	3,753 *	1,573 *
Tapioca, pearl	5,470	5 630	5,222

† hundreds. * net imports.

METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1958

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes				At 4	At 1				Number of Days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	foot ° F	feet ° F	Total	Most in a day Amt.		Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
Ipoh, Perak	94.6	74.8	84.7	96.5	71.8	90.9	77.4			11.01	279.7	2.35	18	16	10			248.55	8.28	
Kuala Lumpur, Selangor	93.0	74.4	83.7	95.4	72.1	89.2	76.8			13.24	336.3	2.69	17	14	12	4		230.00	7.67	
Sitiawan, Perak	91.5	74.5	83.0	93.9	12.8	84.9	76.4	86.1	86.2	3.45	87.6	1.12	12	9	3			257.30	8.58	
Kuantan, Pahang	90.7	72.9	81.8	94.4	67.1	86.3	76.6	85.6		2.12	53.8	0.81	11	7	3	1		241.35	8.05	
Bayan Lepas, Penang	89.9	76.2	83.1	91.4	72.0	87.6	78.8			11.30	287.3	6.63	15	11	8			261.60	8.72	
Malacca	90.4	74.9	82.7	92.9	73.1	87.0	76.7			6.22	158.0	1.84	12	10	4			230.85	7.69	
Mersing, Johore	90.0	73.5	81.7	92.2	70.8	87.0	79.0			2.74	69.6	0.89	6	6				269.10	8.97	
Alor Star, Kedah	96.2	74.2	85.2	99.2	71.6	94.2	76.7			3.25	82.6	2.03	12	9	1	2		284.20	9.47	
Kota Bharu, Kelantan	91.0	74.6	82.8	93.2	71.5	88.8	77.7	91.4	89.7	1.24	31.5	0.70	7	4				304.20	10.14	
K. Trengganu, Trengganu	89.6	74.0	81.8	91.6	69.7	87.2	76.4			3.05	77.5	1.44	8	8				296.15	9.87	
Singapore	90.8	75.5	83.7	93.2	71.6	88.3	77.8			3.25	82.6	1.22	6	5				215.60	7.19	
HILL STATIONS																				
Cameron Highlands, Tanah Rata, Pahang. (3750 ft.)	75.8	55.6	65.7	78.5	45.5	72.0	63.0			97.3	247.1	1.72	20	19				159.45	53.1	

Compiled from returns supplied by the Malayan Meteorological Service.

Replanting soon?

. . . then *Imperator Cylindrica* will have to go

Shell Lallang Oil is the safest, simplest, and most efficient weedkiller for clearing lallang. Safe to use anywhere. On river banks, near pasture land or byeways, there is no danger. Young rubber is quite tolerant of the occasional, accidental drift and risk of harming the trees while clearing the lallang is negligible. But it is not only safety. Shell Lallang Oils need fewer applications than arsenical weedkillers, and are unlikely to be washed off by rain before they can work. The cost of treating an estate can vary greatly from place to place, but an average cost of eradicating lallang with Shell Lallang Oil is $150 an acre including labour, transport and depreciation of spraying equipment. This is the modern way, the safest way and in the long run the cheapest way of performing this essential task. *For further information consult your nearest Shell branch*

SHELL LALLANG OILS

SHELL

here's the root of the termite problem

not only for termites

As well as termites, Dieldrex 15 controls ants, bugs, fleas, cockroaches, mosquitoes and other insect pests. It has been found unsurpassed against adult mosquitoes in homes and labour lines, and is used extensively by the World Health Organisation for malaria eradication. When full use is made of this insecticide's unique residual life, very substantial savings in the cost of malaria control are possible.

Termites dig deep into the roots of a tree and cause serious damage where it can't be seen. The taproot shown above exhibits typical effects of subterranean termite attack; if left alone this would soon result in lower yield. At the first sign of termites, apply Dieldrex 15. It is efficient, easy to handle, and its exceptionally long residual life makes it cheap to use. (The Rubber Research Institute has reported that soil remains lethal to termites for at least two years after one application of Dieldrex 15).

DIELDREX 15

SHELL

The ideal estate insecticide.

A. 103-50

INTERNATIONAL DROTT SKID-SHOVEL

MODEL B-6-K3.

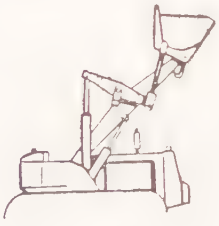
THE BRITISH BUILT 50 H.P., 1CU. YD. UNIT WITH ALL THE FEATURES

Shown at left a Model B-6-K3 fitted with the exclusive "4 in 1" Bucket.

With this new, exclusive attachment fitted in place of the standard bucket, the Drott can function as BULLDOZER, BULLCLAM, CLAMSHELL or SHOVEL. A conveniently located indicator-rod shows the operator the angle of the cutting edge in relation to the ground. He can thus accurately regulate the depth of cut without watching the work performed.

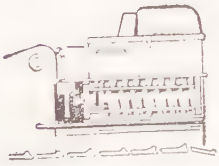
★ **PRY-ACTION BREAK-OUT**

This gives the Model B-6-K3 International Drott Skid-Shovel a break-out force of over 8,500 lbs.—a force nearly three times greater, pound for pound, than the loader's lifting capacity! Through the application of the FIRST-CLASS leverage principle, the bucket is rolled back over full size SKID-SHOES which are mounted on the *lift frame*. The strain of the tremendous leverage load is directed through these shoes into the ground—*there is no strain on the tractor's front idlers.* The Drott obtains the maximum degree of bucket roll-back *at ground level*—and the degree remains constant at any bucket height.



★ **PARALLELOGRAM LIFTING PRINCIPLE**

This gives the Model B-6-K3 International Drott the high lift of 9 ft. 11 ins. and the long forward pitch of 4 ft. 8 ins. without putting excessive strain on the extended members. It also automatically keeps the bucket level during lifting, yet allows full control to be exercised at any height.



★ **HYDRO-SPRING SHOCK ABSORBER**

This has been a feature of Drott Skid-Shovels for over 10 years and is the most efficient shock absorbing device ever incorporated in any hydraulic loader. It consists of a hydraulic cylinder within a heavy coil spring. When shock loads are forced on to the main lifting cylinders, the forcibly-displaced oil is channelled into the Hydro-Spring cylinder, causing the spring to compress and so cushion the impact.

Sole Distributors:—

UNITED ENGINEERS LIMITED

Singapore, Kuala Lumpur, Ipoh, Penang, Malacca, Sandakan.

BETTER COPRA . . .

the "CHULA" way

* Quicker
* easier
* more economical

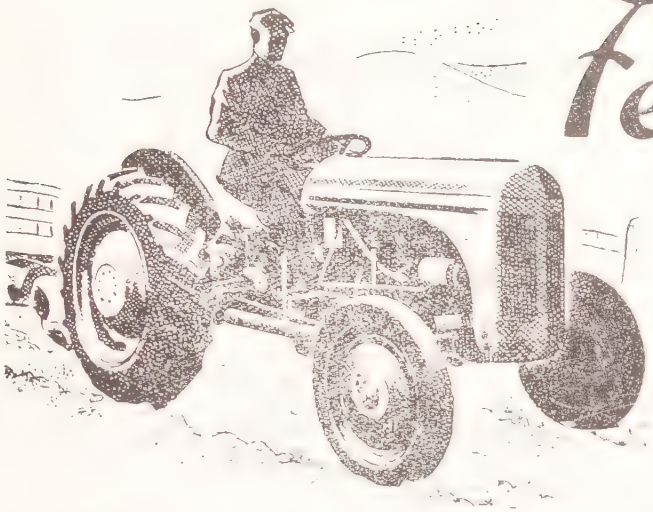
Practical experience has proved that, where "CHULA" Copra Dryers are used, better quality Copra is produced when dried by this scientific process. No discolouration, free from mould, thoroughly and evenly dried throughout, Copra can be produced the whole year round—irrespective of the weather. By the way, are you growing RUBBER? If so, let us supply you with the latest Huttenbach Rubber Machinery. Further information gladly supplied on request.

CHULA & HUTTENBACH PLANTATION MACHINERY
Encircles the Tropics

Agents: **PAPUA:** The B.N.G. Trading Co. Ltd., Port Moresby.
NEW GUINEA: Burns Philp (New Guinea) Ltd., Rabaul, Lae, Madang and Kavieng.
FIJI, SAMOA, TONGA: Morris Hedstrom Ltd., Suva, Fiji.
SOLOMON ISLANDS: K. H. Dalrymple Hay Esq., Honiara.

Tyneside Foundry & Engineering Co., Ltd.

Patentees and Sole Manufacturers Established 1898
Elswick - Newcastle upon Tyne - England
Cables: "Foundry, Newcastle-on-Tyne." Codes: ABC 5th & 6th Editions.
Agents in Malaya: Sime Darby & Co., Ltd., Singapore.



Ferguson

recommend

* FOR DIESEL ENGINES

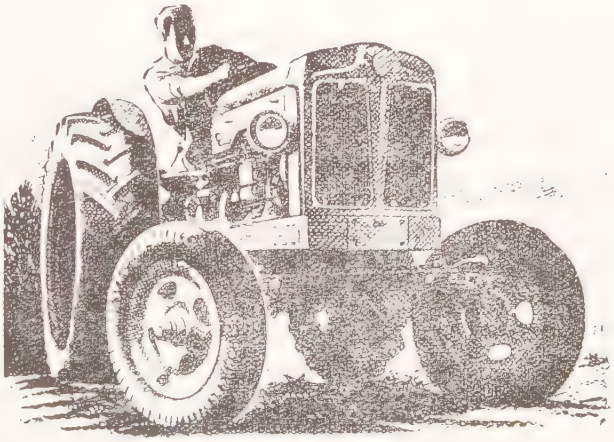
WAKEFIELD DEUSOL ENGINE OIL

* FOR PETROL-VAPOURISING ENGINES

WAKEFIELD Castrol MOTOR OIL

is approved for

FORDSON MAJOR DIESEL



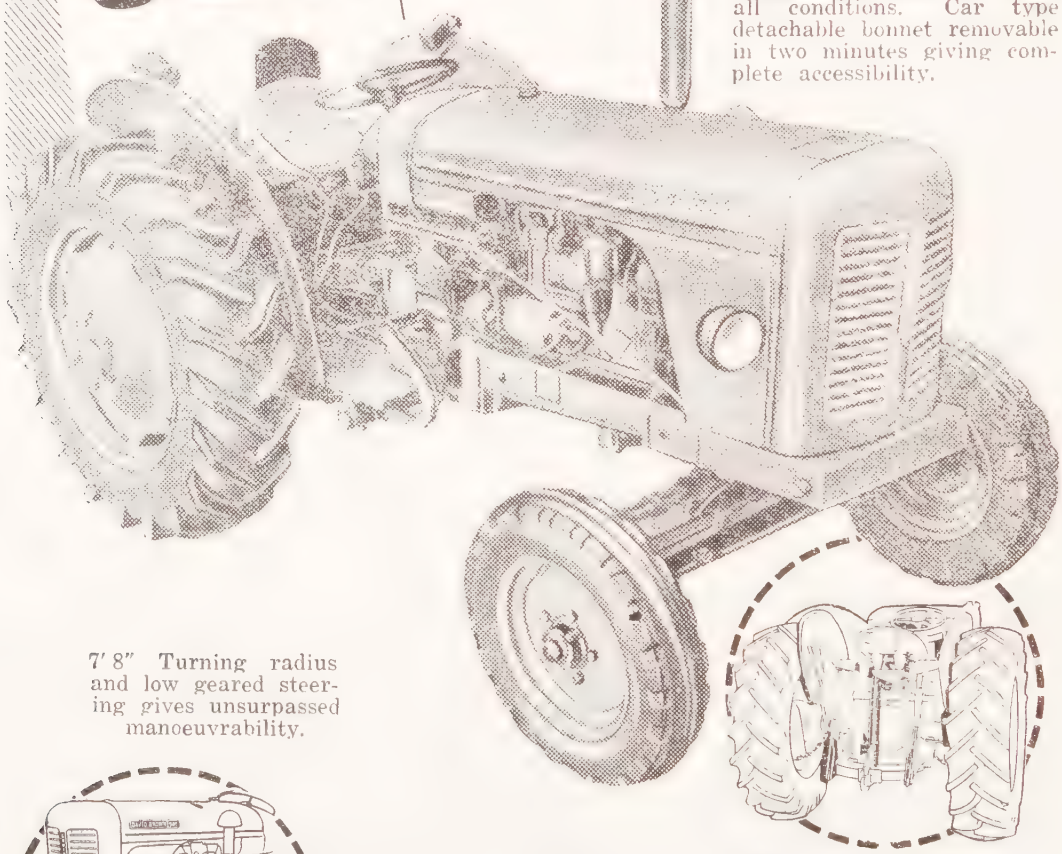
C. C. WAKEFIELD & CO., LTD.,
KUALA LUMPUR — SINGAPORE — PENANG

DAVID BROWN

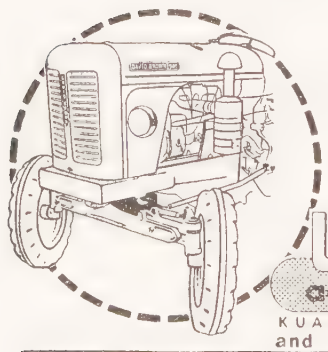
900

New features and proved features

The new powerful David Brown 900 with its 40 H.P. diesel engine and patent traction control unit gives unsurpassed traction under all conditions. Car type detachable bonnet removable in two minutes giving complete accessibility.



7' 8" Turning radius and low geared steering gives unsurpassed manoeuvrability.



Hydraulic lift for heaviest implements, with category one or two linkages.

Wearne's

agricultural and heavy equipment division

KUALA LUMPUR — PENANG — IPOH — SEREMBAN — MALACCA

and at FEDERATED MOTORS LIMITED, SINGAPORE

THE

MAHA MAGAZINE

KEEN GARDENERS—

AND THOSE NOT YET SO KEEN—

WILL ALL BE INTERESTED IN THE NEW EDITION

OF THE **MAHA MAGAZINE**

HORTICULTURE

Livestock

IN KAMPONG & COUNTRYSIDE

The Post Bag

ASK YOUR BOOKSELLER

or

Apply to Secretaries:

Messrs. WALGRENS LTD.,

Kwong Yik Chambers, High Street, Kuala Lumpur.

MINISTRY OF AGRICULTURE PUBLICATIONS

A new publication in the Agricultural Department's Bulletin series

Bulletin No. 103

"The Economics of Padi Production in North Malaya, Part I"

(Land tenure, rents, land use and fragmentation)

by T. B. Wilson, Agricultural Economist.

The report of a statistically based sample survey of the padi farms of North Malaya.

Price: $3/-

available from :

THE DEPARTMENT OF AGRICULTURE,
Federation of Malaya,
Kuala Lumpur.

THE INDIAN COCONUT JOURNAL

(Published Quarterly by the Indian Central Coconut Committee)

The only Journal devoted to the Indian Coconut Industry. Circulated extensively in the States of Kerala, Mysore, Madras, Bombay, Orissa, West Bengal, Assam etc. Is read in dozens of Libraries, Colleges and Research Institutions. Ideal medium of advertisement to reach the agricultural intelligentia of the rich coconut growing areas of India.

Rates for Advertisements

Back Cover (Outer)	per insertion	....	....	....	Rs. 175
Front Cover (Inner)	,,	....	....	....	Rs. 150
Back Cover (Inner)	,,	....	....	....	Rs. 120
Inside Page not facing reading matter			....	....	Rs. 100
Half Page	,,	....	....	....	Rs. 60
Quarter Page	,,	....	....	....	Rs. 30

All space facing reading matter will be charged 20 per cent extra. A rebate of 20 per cent will be allowed for more than three consecutive insertions.

Subscription Rates

Inland	Annual	....	Rs. 4/-	....	(including postage)
Foreign	Annual	....	Rs. 4.57	....	(including postage)
Inland	Single copy	....	Rs. 1/-	....	(including postage)
Foreign	Single copy	....	Rs. 1.15	....	(including postage)

For further details please apply to:—

THE SECRETARY,
Indian Central Coconut Committee,
Ernakulam, S. India.

AVAILABLE PUBLICATIONS OF THE DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA.

LEAFLETS (Issued free for circulation in the Federation of Malaya only)

AGRICULTURAL SERIES

No. 1. Derris. (1948). E.
4. Groundnuts. (1949). E.
9. Pepper. (1956). C M E
16. Budgrafting Fruit Trees, (1950). E
25. Manila Hemp. (1947). E
26. The Black Beetle. (1947). E
28. Ramie. (1950). E
29. The Coconut Leaf Moth. (1951). E
30. Fermentation and Drying of Cacao Beans. (1956). E
31. Cacao. (1955). C M E
32. The Establishment and Maintenance of Fruit Trees. (1956). C M E
33. Patchouli. (1957). C M E
34. Oil Palm. (1956). E
35. Home Canning and Jam Making. (1957). C M E
36. The Pineapple in Malaya. (1958). C M E
37. Coffee. (1958). C M E
38. Grow Your Own Nutritious Vegetables. (1958). M E
39. Soil Conservation and Erosion Control. (1958). C M E

POULTRY LEAFLETS

No. 1. Systems of Poultry Keeping. (1954). C M E
2. The Housing of Poultry. (1955). C E
3. The Feeding of Poultry. (1954). C M E
4. The Choice of Stock. (1955). C E
5. Duck Keeping. (1958). C M E

M = printed in Malay. C = printed in Chinese. E = printed in English.

RECENT BULLETINS

No. 101. Pot Experiments on the Insecticidal Control of Padi Stem-Borers. (1956). $1.50.
102. Field Investigations of Padi Stem-Borers. (1955-56). $1.50.
103. Economics of Padi Production in North Malaya. Part I. (1958). $3.

SCIENTIFIC SERIES (Discontinued after No. 26)

No. 2. Investigations on Panama Disease in Malaya. (1930). $1.
3. An Historical Note on *Tirathaba rufivena* Walk. (The Greater Coconut Spike Moth) and its Three Parasites in Malaya, and Preliminary Observations on *Sogata* spp. Pests of Padi. (1930). 50 cents
4. Bionomics and Control of *Leptocorisa acuta* Thunb. (1930). $1.
9. Hydnocarpus Oils in Malaya. (1932). 50 cents.
10. An Examination of the Geology and Soils of an Area in the State of Perak, F.M.S. (1932). 50 cents.
11. Lac in Malaya (Part I). (1933). 50 cents.
15. Notes on Hymenopterous Parasites of Padi Pests in Malaya. (1934). 50 cts.
16. The Toxic Value of *Derris* spp. (1935). 50 cents.
17. The Termite, *Microtermes pallidus* Hav., in Relation to Tea in Malaya. (1936). 50 cents.
18. The Oriental Migratory Locut (*Locusta migratoria manilensis* Meyen) and the Bombay Locust (*Patanga succincta* L.) in Malaya. (1936). 50 cents.
19. Lac in Malaya (Part II). (1937). 50 cents.
20. Insects, Fungi and Bacteria Associated with Copra in Malaya. (1937). 50 cents.
21. Observations on Stem-Rot of the Oil Palm. (1937). 50 cents.
22. The Identification of Grubs from Rubber Estates. (1939). 50 cents.
23. Malayan Food Composition Table. (1949). $2.
24. Fodders and Feeding Stuffs in Malaya. (1951). $5.
25. Rice Variety Trials in Malaya, 1947-50. (1953). $5.
26. Rice Variety Trials in Malaya, 1950-54. (1955). $5.

GENERAL SERIES (Discontinued after No. 32)

No. 2. The Brazil Nut in Malaya. (1930). 50 cents.
9. The Cultivation and Manufacture of Tea in Ceylon and India. (1932). $1.
10. Insects of Coconuts in Malaya. (1932). $1.50.
23. The Coconut Industry of the Philippine Islands. (1936). 50 cents.
28. The Practical Aspects of Copra Deterioration. (1937). 50 cents.
29. The Cultivation of Lowland Tea at the Central Experiment Station, Serdang. (1937). 50 cents.
31. Malay Leaf and other Vegetables and their Analyses. (1940). 50 cents.
32. The Pineapple Industry of the Hawaiian Islands. (1949). $5.

ECONOMIC SERIES (Discontinued after No. 15).

MECHANISATION SERIES (Discontinued after No. 1).

No. 1. Investigations into the Mechanical Cultivation of Padi in Malaya. (1951). $2.

DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA.

The Director of Agriculture invites those interested to visit the College of Agriculture, Serdang, Selangor, and the various Federal and State Stations throughout the Federation Malaya. Intending visitors to the College of Agriculture should communicate with the Principal; to the Federal Experiment Station, Serdang, Selangor, with the Agronomist-in-charge; and to other Federal and State Stations with the State Agricultural Officers. The following is a list of Agricultural Stations on which can be studied the more important lines of investigation and extension at present carried out by the Department.

Correspondence concerning the experiments at any of these Stations should, if it originates in Malaya, be addressed to the State Agricultural Officer, concerned; correspondence originating in any other country should be addressed to the Director of Agriculture, Federation of Malaya, Kuala Lumpur.

Wet Padi.

SELECTION WORK. Telok Chengai, Kedah; Titi Serong, Simpang Tiga and Talang, Perak; Pulau Gadong, Malacca; Kota Bharu and Jelawat, Kelantan; Kendong, Ulu Klawang and Ampang Tinggi, Negri Sembilan; Tangkak, Johore; Genting and Bukit Merah, Penang and Province Wellesley; and other State Stations.

AGRONOMIC INVESTIGATIONS. Most Padi Experiment and Test Stations.

PADI MECHANISATION SCHEME, Parit, Perak.

Dry Padi.

Melor, Kelantan, and Paya Besar, Pahang.

Rubber.

Budwood and clonal seedling nurseries. Most State Agricultural Stations. Replanting demonstration plots in all States.

Tea.

Federal Experiment Stations, Cameron Highlands and Serdang.

Oil Palm.

Federal Experiment Stations, Serdang, Selangor, and Jerangau, Trengganu.

Coconut.

Federal Experiment Station, Telok Bharu, Perak, and Coconut (Rehabilitation) Station, Sungei Sudah, Muar, Johore.

Cacao.

FEDERAL EXPERIMENT STATIONS. Serdang, Selangor, and Jerangau, Trengganu.

AMELONADO SEED GARDENS. Sik, Kedah; Batang Merbau, Kelantan; Ayer Itam, Penang; Layang Layang Kiri and Bukit Gantang, Perak; Temerloh, Kuala Lipis and Pekan, Pahang; Ampang Tinggi, Negri Sembilan; Sungei Udang, Malacca; Ayer Hitam, Tangkak, Johore; Sungei Tong, Trengganu.

Pineapple.

Jalan Kebun, Selangor, and Alor Bukit, Johore.

Manila Hemp.

Federal Experiment Station, Serdang, Selangor; Degong, Perak; and Sungei Ruan, Pahang.

Fruit Propagation.

Federal Experiment Station, Serdang, and all State Agricultural Stations.

Vegetables.

Federal Experiment Stations, Kuala Lumpur and Cameron Highlands.

Poultry.

Federal Experiment Station, Cameron Highlands and most State Agricultural Stations.

Livestock.

PIGS: Federal Experiment Stations, Serdang and Cameron Highlands; Sungei Buloh and Jenjarom, Selangor; Mah San, Negri Sembilan; Raja Hitam (Dindings) and Teluk Bharu, Perak; Pulau Gadong, Malacca; and Ayer Itam, Penang.

GOATS: Ayer Itam, Penang; Bukit Mertajam, Province Wellesley; Sungei Udang, Malacca; Cheras, Setapak, Sabak Bernam and Federal Experiment Station, Serdang, Selangor; Chembong, Negri Sembilan.

Pastures.

Federal Experiment Station, Serdang, Selangor.

PRINTED BY THE ECONOMY PRINTERS LTD., KUALA LUMPUR.